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Cutting Costs In the Soo Line Repair Shops

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Western Editor, *American Machinist*

Special tools for saving time — Quantity production in the tool room—A good slotting attachment—Welding a cracked saddle — Punching holes in staybolts

THE NECESSITY for increasing revenue by the only method possible for a railroad—that of reducing expenses—has for some time been focusing attention on the mechanical departments. The effort to save time and cut costs in the shops of the Minneapolis, St. Paul and Sault Ste. Marie Railways, Minneapolis, Minn., has resulted in the development of many interesting tools and methods, some of which are described in what follows.

A special machine that has been developed to mill saddle pockets in driving boxes is illustrated in Fig. 1. The machine consists of a frame carrying a carriage that supports a vertical spindle *A* as shown. The carriage can be moved in either direction in a horizontal plane by means of the handwheels *B* and *C*. The spindle sleeve *A* is threaded inside to receive the piece *D*, which supports an air drill. The spindle of the drill is inserted downward into the support, and is connected with an extension spindle that carries the cutter *E*. The cutter is an end mill 1¼ to 1½ in. in diameter, depending on the size of the driving box. Handles on the support *D* provide for raising or lowering the tool and a locking collar holds the tool at the desired height. The piece *F*, which is bolted to the carriage, is slotted to receive one of the air-drill handles and thus prevents the air motor from swinging around with the spindle when the air is turned on.

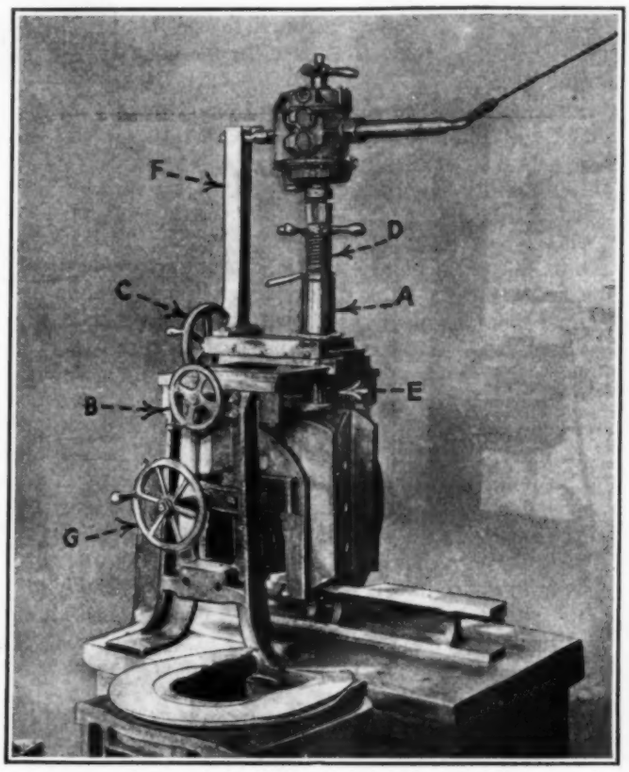

Fig. 1—Milling saddle boxes and driving boxes

The driving box rests on a parallel between the legs of the machine where it is clamped in position by means of a clamp on the end of a screw that is operated by the handwheel *G*. A square thread is cut on the screw to correspond with the thread in a steel block bolted to the frame of the machine to serve as a nut. The speed of the spindle is approximately 156 r.p.m., and the amount of stock removed is usually from ¼ in. to $\frac{3}{16}$ in. A driving box can be finished on this operation in approximately 30 minutes.

Another interesting operation on driving boxes is that of cutting the oil grooves in the shoe and wedge faces shown in Fig. 2. The machine is a Niles radial drill and the tool used is similar to that shown in the sketch, Fig. 3. The cutters are of $\frac{3}{8}$-in. square carbon steel, ground and set to cut a ring groove $\frac{3}{16}$ in. wide on a circle 4 in. in diameter. The spindle speed is 35 r.p.m. and the tool is fed by hand.

When a driving box becomes so badly worn on the shoe and wedge faces that it is unfit for further use, the worn sides are planed down and a section of steel plate is welded into each side as shown in Fig. 4. The steel section, which in this case is ½ in. thick, is machined off on the sides at a 45-deg. angle and is then set in place and welded in by filling in

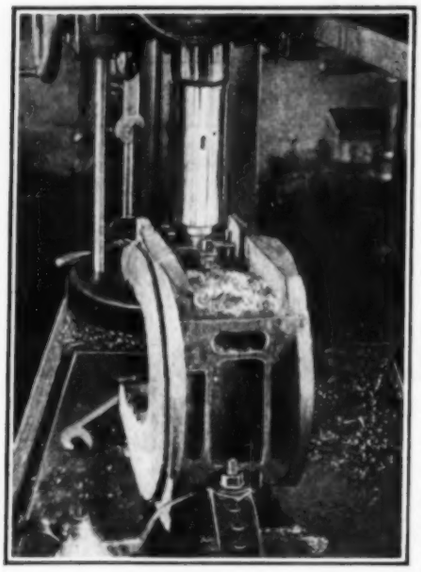

Fig. 2—Cutting oil grooves in driving boxes

the groove at each side with iron. The welding outfit is made by the Lincoln Electric Co., Cleveland, Ohio. A piece can be welded into a driving box in approximately 2½ hours. Tool room efficiency has come in for its share of attention in the Soo shops and a number of excellent tools and methods have been developed. When not employed on other work the toolmakers are kept busy making new taps, reamers, or similar small tools. The illustration, Fig. 5, shows a set-up for milling flutes in 1-in. spindle taps, using a Cincinnati No. 2 milling machine. Three pieces are machined at a setting, and the head ends of the pieces are locked onto centers that are revolved by the operation of a dividing head which operates a train of gears to which the centers are connected. This set-up is also used for milling flutes in other taps, reamers and "Lagonda" arch-tube cutters. The flutes can be milled in from 9 to 12 staybolt taps in 8 hours while smaller taps—from ¼-in. to ⅝-in.—can be produced at a rate of from 60 to 100 in 8 hours. From eight to twelve frame-bolt reamers of from 8 to 12 in. in length are produced in 8 hours. Small tools are produced in lots of 100 or more, as it is considered that this quantity is necessary in order to keep the cost of production down to the market price.

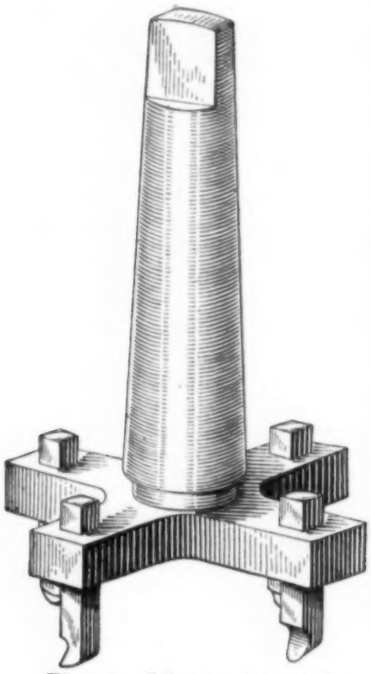

Fig. 3—Oil-grooving tool

The illustration, Fig. 6, shows a set-up for milling the flat surfaces of bolt-cutter die blocks similar to the one shown at *A*. The material is ½-in. stock and will be finished to 7/16 in. A 2¾x9-in. cutter with eleven spiral blades is used, a cutter of this length making it possible to machine four pieces at a setting. The pieces are held in a vise fixture, as shown, and are forced against the knife-edge locator *B* by the action of the four single-point clamps *C*. The clamps are attached to an equalizer so that an equal amount of pressure is brought to bear on each of the four pieces of work, and are so arranged that the points of the clamps bear downward as the clamps are forced against the work. This is accomplished by a cam action under the rear ends of the clamps, which is controlled by the screw *D*. The feed is 0.033 in. per revolution with the cutter operating at 54 r.p.m., or 39 ft. per minute. A limit of 0.001 in. only is allowed and the four pieces are finished complete in 45 minutes.

Another interesting job is that of slotting solid die nuts, using a slotting attachment on a milling machine as shown in Fig. 7. The work is held in a chuck attached to a dividing head. The attachment consists of the piece *A*, Fig. 8, which screws onto the nose of the machine spindle, and the frame *B*, which is bolted to the face of the column. To the cutter bar *C* is attached the hardened steel block *D*, which is slotted for a sliding fit on the pin *E*. The pin *E* is a hardened and ground bushing, held in place by a countersunk head screw. When the machine is in operation, piece *A* acts as a crankshaft and moves the cutter bar back and forth with a reciprocating motion. A key in the side of the cutter bar rides in a slot in one of the bearings and prevents the bar from turning. The tool, which is held in the end of the cutter bar, is of ½-in. round high-speed steel, ground to the desired shape. The pin *E* can be moved to either of the other two holes in the piece *A* so that, as these holes are of various distances from center, the length of the stroke can be varied to suit the work. The speed is also varied to suit the work, although the average speed is thirty-eight strokes per minute. The time required to finish the piece shown is 20 minutes.

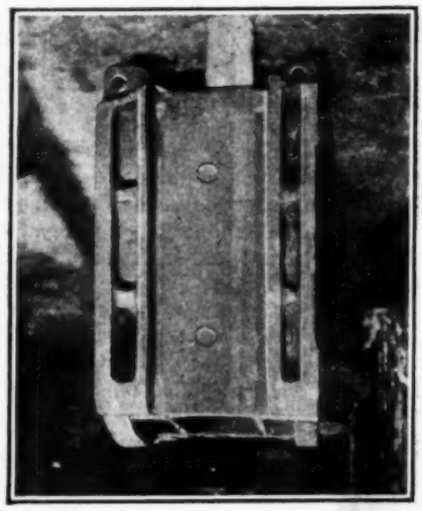

Fig. 4—Reclaiming driving boxes with the welding torch

The welding torch is used extensively in the Soo Line shops, either gas or electricity being used wherever possible. The illustration, Fig. 9, shows how a cracked saddle is repaired by welding. Electricity is used in this instance, as it is stated that the gas torch heats the work too much. Two cracks were discovered in the saddle, as indicated by the two double rows of studs. To prepare the cracks for welding, the rough edges were chipped away and the grooves were then smoothed up with a portable grinding wheel. Then a row of holes was drilled on each side of each crack and tapped for ⅝-in. studs, to be set in approximately ⅝ in. deep and ¾ in. apart. From 1/16 in. to ⅛ in. of stud was left sticking up above the surface. As each groove was approximately ⅝ in. deep by ¾ or ⅞ in. wide, the distance between each double row of studs was from 1 in. to 1½ in. A Lincoln welder outfit was used and the welding material was 5/32-in. diameter iron that had been cut into 15-in. lengths. Fig. 10 shows how one of the

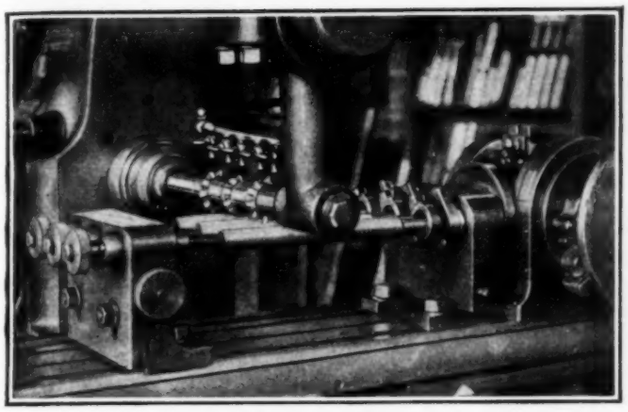

Fig. 5—Milling flutes in taps

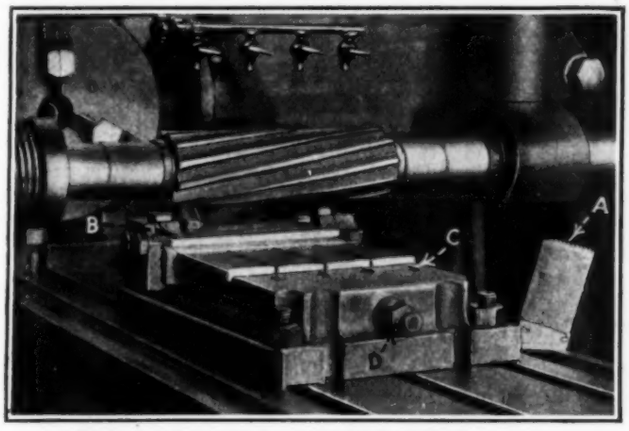

Fig. 6—Finishing sides of thread chasers

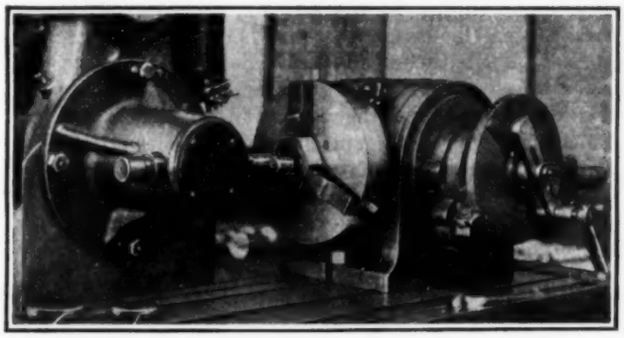

Fig. 7—An excellent slotting attachment

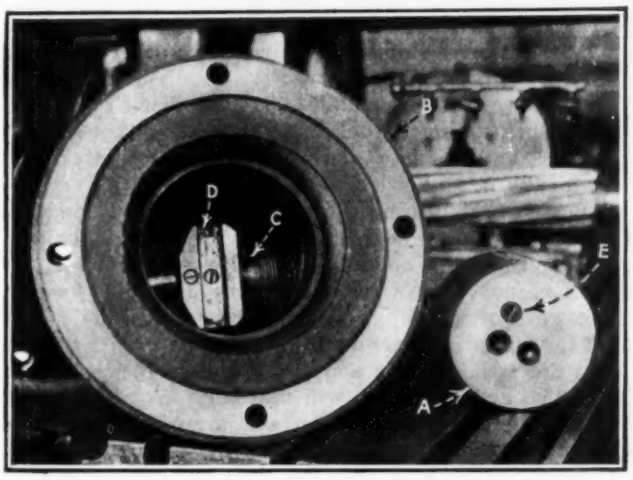

Fig. 8—Working parts of slotting attachment

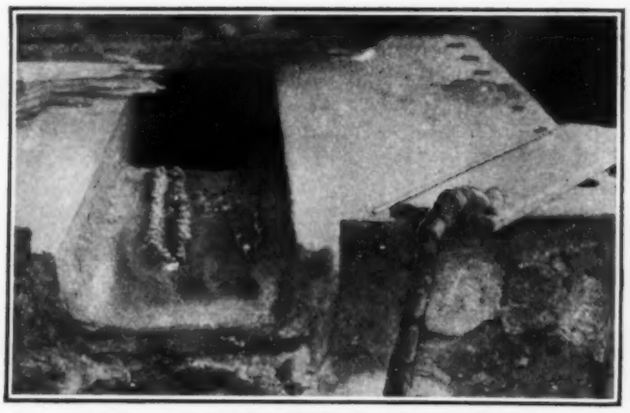

Fig. 9—A cracked saddle ready for welding

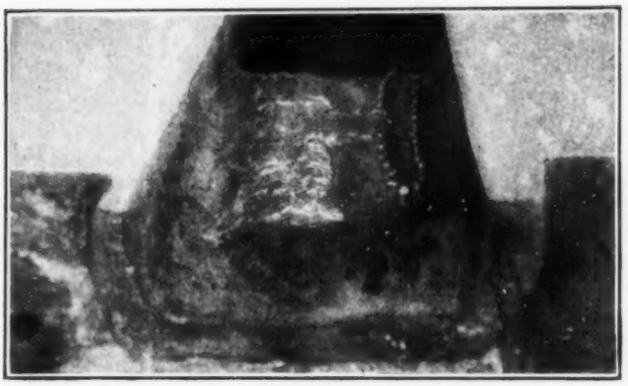

Fig. 10—How the weld is made

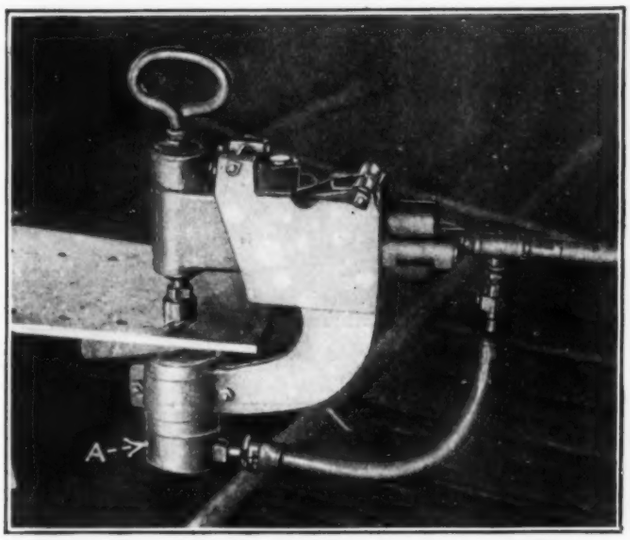

Fig. 12—A boiler plate countersinking tool

cracks looked after it had been repaired. Not only was the crack filled with iron, but the studs were completely covered so that a good, strong patch was produced. No repairs of this nature have failed up to this time.

The welding torch is also used to a large extent in the boiler shop, the intentions being to eliminate riveting on all jobs where no great stress occurs. In the illustration, Fig. 11, two men are shown welding a firebox. The man inside the box is welding the door sheet to the wrapper sheet, while the other man is welding the flue sheet to the wrapper sheet. The firebox is welded inside and out, a double weld being effected all around. The whole job takes 12 hours.

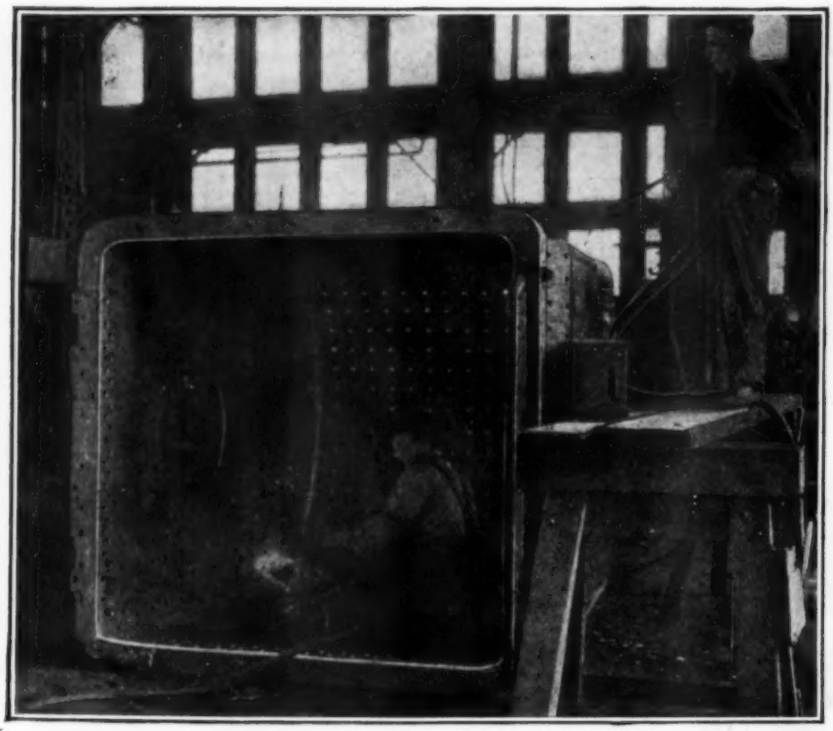

Fig. 11—Welding firebox sheets

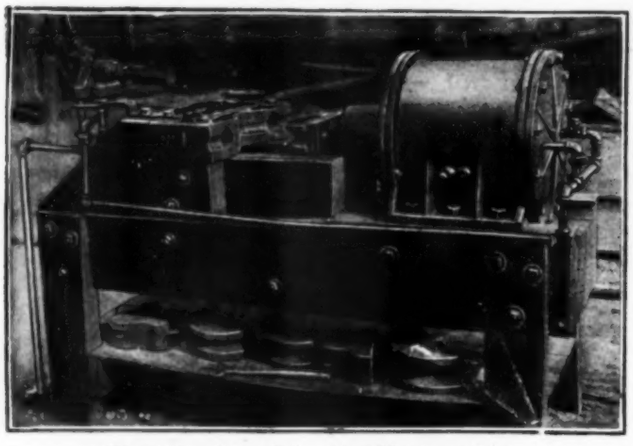

Fig. 13—Air piping bending machine

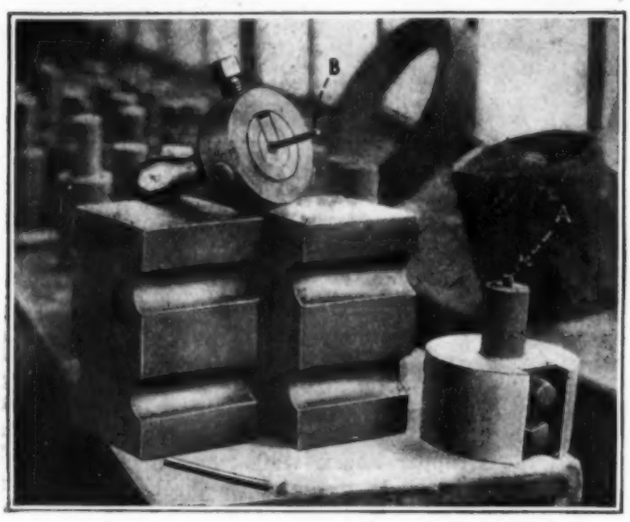

Fig. 14—Tools for punching holes in staybolts

An interesting tool for countersinking holes in boiler plates is shown in Fig. 12. Attached to an air "corner" motor is a frame that carries a small air cylinder and piston, as shown at *A*. When the point of the tool is placed in a hole and the air is turned on, the piston immediately rises against the under side of the plate and pulls the tool down into the hole, thus acting as a feeding device. One man can operate the tool and countersink three holes per minute. The tool can be handled much easier than a side or flue sheet, and the use of the "old man" is eliminated.

Air is made to do a variety of jobs around these shops, including that of bending pipe. The illustration, Fig. 13, shows a 16-in. Westinghouse air-brake cylinder that has been rigged up for this purpose. The air is controlled through a Westinghouse straight air-brake valve, and a pressure of approximately 110 lb. to the square inch is obtained. Pipe of 3-in. diameter has been bent in the machine, and dies for various sizes of air, steam and water pipe can be seen on the bench under the cylinder. The dies are of cast iron.

That the blacksmith shop is also keeping abreast of the times is evidenced by the tools shown in Fig. 14. These are the punches and dies for punching holes in staybolts. The punch indicated at *A* is $\frac{7}{8}$ in. diameter and punches a hole $\frac{7}{16}$ in. deep. The punch *B* is $\frac{3}{32}$ in. diameter and enters the piece $1\frac{5}{8}$ in., as required by the United States Government laws. The bolts are punched while hot, and both holes are punched at one operation, using an Acme $1\frac{1}{2}$-in. bolt machine. These holes were originally drilled, and the operation was considered a very troublesome and expensive job. With the tools shown an average of 2,500 staybolts can be punched in 8 hours. The punch *A* usually wears out from contact with the hot iron, but it averages from 10,000 to 12,000 holes. The punch *B* will average from 1,500 to 2,000 holes, and a punch has been known to punch 3,000 holes before breaking.

Among the changes in machining methods during the last quarter century which stand out most prominently are the increase in milling and grinding. Those who recall the prophecies of John J. Grant and other pioneer advocates of milling know how they were ridiculed and also how they have been fulfilled. It is difficult to imagine how such automobile parts as crankcases, transmission cases and the like, could be handled rapidly and economically in any other way.

Almost the same thing can be said of the development of grinding. Thirty years ago it was largely a polishing operation removing an almost infinitesimal amount of metal and not always having a very desirable finish. The growth of grinding, however, has practically relegated the lathe to a machine for rough turning. Finishing in the lathe is now almost an unknown operation. Those who are interested will find very instructive information in the old files of the *American Machinist*, beginning back as far as 1890 or even earlier. These old issues contain much valuable data as to the changes which have taken place.

What About the Trade Associations?

By Edward Eyre Hunt

Tendency of United States Supreme Court to limit activities of trade associations—What the Tile and Cement decrees make illegal—Effect on collection of statistics

"SECTION ONE. *Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several states . . . is hereby declared to be illegal.*"[1]

The activities which these words, from the Sherman Act of July 2, 1890, may cover have been increased as a result of the "consent" decree in the case of the Tile Manufacturers Credit Association and the decree carrying out the decision of the court in the case of the Cement Manufacturers Protective Association. But the chief importance of these decrees is that they fall in a logical series of court decisions and consent decrees affecting trade associations, and that the end is not yet.

The significant history of these cases begins with the decision of the Supreme Court in the Hardwood case, Dec. 19, 1921. This was followed by the correspondence of Secretary Herbert Hoover and Attorney General Harry M. Daugherty between Feb. 3 and Feb. 9, 1922. The evident purpose of the Secretary of Commerce in this correspondence was to clear up so far as may be lawful the status of the various activities of trade associations. The theory on which he proceeded was that no rule or regulation can be devised to prevent men from committing crimes if they are so minded. The best that can be done is to forbid the committing of certain acts or to commend the doing of others, prescribing proper punishments in the case of the commission on the one hand and the omission on the other. The Secretary of Commerce declared that the fact that a minority may be known to have violated the law does not establish the principle that a means, lawful in itself, which they have adopted for the purpose of performing unlawful acts, should be abolished and its use forbidden to law-abiding citizens.

It can be assumed that the majority of trade associations are legitimate both in form of organization and in activity, and it can be assumed that the activities which the Department of Justice has most actively combated were in those cases being used for unlawful ends. But while there may be common agreement on these two points the difficulty is that there is a twilight zone in which honest difference of opinion is still possible and that the efforts of the Department of Justice to narrow the zone of permissible activities appear to be destructive of what must seem to many to be legitimate activities, particularly those relating to the collection and dissemination of statistics.

The most important of the recent decisions is the unanimous decision of the Supreme Court on June 4, 1923, in the Linseed Oil case, a decision written by Justice McReynolds, which establishes the principle that "concerted action through combination . . . is forbidden *when the necessary tendency is to destroy the kind of competition to which the public has long looked for protection.*" And further that: "If, *looking at the entire contract* by which they are bound together *in the light of what has been done under it*, the court can say that its *necessary tendency is to suppress competition in trade between states, the combination must be declared unlawful.*" The court here refers to its decision on Dec. 10, 1921, in the case of the American Column and Lumber Company where the activities of a trade association are held "within the inhibition of the Sherman Act because of *inevitable tendency to destroy real competition as long understood*, and thereby restrain trade."

The principles here established are new, perhaps ominous. The court evidently believed that the "necessary tendency" of certain instrumentalities is to destroy competition.

But the activities specified in the Linseed Oil decision and from which the members individually and collectively are perpetually enjoined are discussed as follows: The "defendants, large manufacturers and distributors—powerful factors in the trade—of commodities restricted by limited supplies of raw material (linseed), located at widely separated points and theretofore conducting independent enterprises along customary lines, suddenly became parties to an agreement which took away their freedom of action by requiring each to reveal to all the intimate details of its affairs. All subjected themselves to an autocratic Bureau, which became organizer and general manager, paid it large fees and deposited funds to insure their obedience. Each subscriber agreed to furnish a schedule of prices

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[1] The Italics throughout are mine. E. E. H.

and terms and adhere thereto—unless more onerous ones were obtained—until prepared to give immediate notice to departure therefrom for relay by the Bureau. Each also agreed under penalty of fine, to attend a monthly meeting and report upon matters of interest to be there discussed; to comply with all reasonable requirements of the Bureau; and to divulge no secrets.

"With intimate knowledge of the affairs of other producers and obligated as stated, but proclaiming themselves competitors, the subscribers went forth to deal with widely separated and unorganized customers necessarily ignorant of the true conditions. Obviously they were not bona fide competitors: their claim in that regard is at war with common experience and hardly compatible with fair dealing."

It was these related activities which the Supreme Court charged with having a "necessary tendency" to destroy competition.

It may be urged that the most ominous statement in the decision in the case of the American Column and Lumber Co. is that which refers to "real competition *as long understood.*"

The Linseed Oil decision is still more definite when it refers to the question of *"competition to which the public has long looked for protection."* To imply that there can be no evolution in competition, but that it must remain static is surely reactionary doctrine, and further to imply that the benefit of secrecy is such that it should not be given up for a possible greater benefit of knowledge is standing pat with a definite leaning backward.

In defense of the court, if it needs defense, one must remember that the court does not consider it its duty to say what associations may or may not do. It is passing upon the facts in the case before it. "We are not called upon," the decision says, "to say just when or how far competitors may reveal to each other the details of their affairs . . . The ordinary practice of reporting statistics to collectors stops far short of the practice which the defendant adopted."

Is Collection of Statistics Illegal?

But furthermore one may certainly argue from this case that the specific activity of collecting and exchanging trade information does not come under the ban, but rather that the sum total of association activities, "in the light of what has been done," is unlawful, of which this statistical activity was only one. The courts have not advanced beyond this point. Hence there is no reason to infer that the collection and dissemination of information is in and of itself illegal. The plain question of the right to collect and disseminate statistical information has never, I think, been submitted to a court unhampered either by the complication of other activities, or by improper use having been made of the information.

The consent decree in the Tile Association case, entered Nov. 26, 1923, contains the most striking declaration to date of the illegality of collecting and disseminating statistical information.

Legally speaking, the consent decree in this case is of small value as a precedent. No court would base a judgment on it. But it is important as reflecting the attitude of the Department of Justice. An association whose activities are in conflict with this decree is in danger of prosecution though perhaps not of conviction.

The court decree in the Cement case resembles at some points the consent decree in the Tile case. For example, the members cannot report to the association cement shipped and in stock, or total shipments during a specified period of time.

The Tile Association members may "receive and compile for transmission to any governmental agency such information and statistics as it may request . . . but are restrained from distributing such information among themselves . . ."

The assumption seems to be that the channel through which the information is obtained by association members and not the use of that information is what the Attorney General desires to regulate. For example, if these association members obtained from a government bureau identically the same information which they formerly obtained from their association secretary the Attorney General apparently believes that the ends of justice are served. The source in the case of the trade association is suspect.

The members may maintain an association for the following objects and purposes "and none other":

(1) for research, publicity, advertisement and similar activities.

(2) to deal with engineering and trade problems, and to secure arbitration in trade disputes.

(3) to carry on educational work of specified kinds.

(4) to maintain a traffic bureau.

(5) to improve sanitation, safety work and similar activities.

(6) to handle insurance.

(7) to maintain a credit bureau. "The gathering of information, solely for the purpose of providing credit information on special request, shall not be considered a violation of any part of this decree."

(8) to secure and maintain "standardization of quality and of technical and scientific terms, and the elimination of non-essential types, sizes, styles or grades of products."

The last paragraph of course is to protect the simplification work now being carried on by various trade associations at the suggestion of the Department of Commerce.

The defendants are "perpetually enjoined, restrained and prohibited from combining, conspiring or agreeing, expressly or impliedly, directly or indirectly, to do any of the following acts":

"(1) To adopt or use a uniform basic price list, or to fix and adopt list prices for their products;

"(2) To establish or maintain uniform prices for their products;

"(3) To establish and maintain individual prices that are uniform for all classes of purchasers or dealers and for all sales;

"(4) To establish or maintain rules or regulations as to the acceptance of orders at prices in effect prior to changes therein;

"(5) To establish or maintain uniform extra charges for built-up letters, for numbers or for beveled edges;

"(6) To establish or maintain uniform limitations on the proportionate amounts of the lower grades of tile sold;

"(7) To sell tiles f.o.b. factory with freight equalized with other factories in the United States manufacturing the same class of tiles;

"(8) To compile and distribute freight rate books for use in making freight equalizations;

"(9) To establish or maintain uniform terms of sale;

"(10) To establish or maintain uniform conditions on or for the acceptance of orders;

"(11) To establish or maintain uniform charges for barrels, half barrels, or boxes used for shipping tiles; to refuse to allow credit for old packages returned; to quote prices with package charges included, and to charge for packages whether used in shipment or not.

"(12) To establish or maintain uniform conditions for the furnishing of tiles for sample purposes;

"(13) To refuse to combine less than carload shipments into carload shipments invoiced to one of the purchasers;

"(14) To refuse to sell to any persons or corporations because of any unpaid account or accounts;

"(15) To formulate and establish or to retain in effect any requirements, circumstances or conditions, non-conformity or non-compliance with which shall exclude any customer or customers from securing credit or shall impose any limitations or conditions whatsoever upon the credit granted;

"(16) To restrict sales to dealers or contractors in tile or to establish uniform requirements for classification as dealers or contractors;

"(17) To establish any system of co-operative purchasing of raw materials or supplies or of co-operative owning of the sources of raw materials, which shall eliminate or tend to eliminate competition in the purchasing of said materials or supplies:

"(18) To adopt or to use a common trademark;

"(19) To pool orders or to enter joint bids;

"(20) To prepare and publish any list or lists of dealers or of certified dealers;

"(21) To advise or communicate with one another as to proposed advances or decreases in prices or to circulate among themselves in any way information concerning or relating to proposed advances or decreases in prices, or to prices charged or to be charged;

"(22) To effect in any manner whatsoever any discrimination of any character in favor of or against any individual or corporation purchasing or attempting to purchase tiles, by reason of the fact that such person or corporation is a mail-order house, or a dealer in other supplies or commodities, or a co-operative purchasing association, or a building contractor, or for any other reason, or to do any act or acts to effectuate any discrimination in favor of or against any person or corporation for any reason whatsoever."

Result of Present Tendency Will Probably Be More Mergers

An inevitable result of present tendencies, if developed to their logical conclusion, will be severely to handicap smaller industrial units to the advantage of the larger units. As Justice Brandeis pointed out in dissenting from the opinion of the majority of the Supreme Court in the case of the American Column and Lumber Co. et al, "May not these hardwood lumber concerns, frustrated in their efforts to rationalize competition, be led to enter the inviting field of consolidation? And if they do, may not another huge trust with highly centralized control over vast resources, natural, manufacturing and financial, become so powerful as to dominate competitors, wholesalers, retailers, consumers, employees and, in large measure the community?"

Vital questions of public policy hang on the status of trade association activities.

One may ask if the Attorney General has sufficiently considered the effect of present tendencies in relation to the voluntary reporting of statistical information to other departments of the Government. They seem certain to affect adversely the work of the Department of the Interior, the Department of Agriculture—in so far as certain bodies are not specifically excepted from the workings of the law—the Department of Commerce, which is charged with the duty of "fostering, promoting and developing the commerce and industry of the United States," and the Department of Labor. The statistical work of these departments is important. In a crisis involving the national defense it might become indispensable. Certainly the men who were faced with the problem of gathering much needed figures in 1917 know how serious is the deficiency.

Relieving the Blueprint and Photostat Burden

By C. E. Hunter

EVERY industrial plant needs blueprints. They have afforded a cheap method of duplicating drawings for many years and are more in use today than ever. We have seen the many stages of development of the blue-printing apparatus from the old and obsolete method of the printing frame, dependent on sunny days for results, to the up-to-date electrical machine of today where tracings are fed in one end and completely washed and dried blueprints come out the other.

Photostats are, however, a newer development. Tracings are made unnecessary and opaque drawings or charts can be duplicated at will and with utmost speed. One of the chief reasons that the photostat does not almost entirely supplant the blueprint is due to the additional expense involved in its use. It is quicker than blueprinting and by its use drawings on current work can be prepared for the shop with utmost promptness, the delay of tracing and blueprinting being avoided.

Under Control of Engineering Department

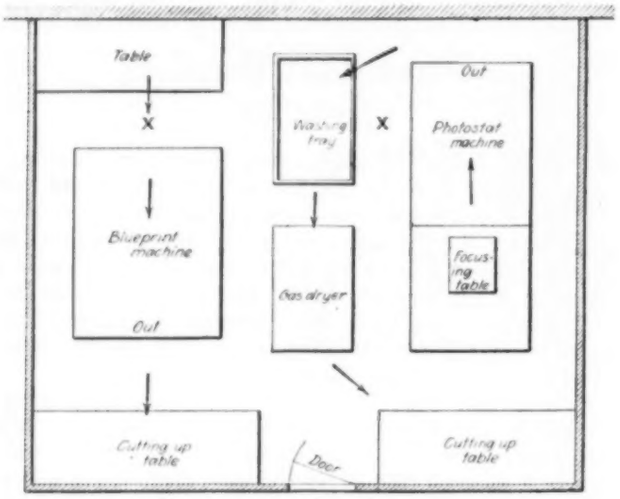
It is pretty generally the custom to have all blueprinting come under the control and direction of the engineering department because, in general, the engineering department keeps all tracings and plant records which would require duplication by this method. The condition with photostats is, however, somewhat different. Photostat work is required by all departments of a plant, due to the fact that letters, contracts, etc., can be readily duplicated by this method with a saving of time, a gain in accuracy and often a saving of expense.

It has been generally found wise, however, to combine blueprinting with the photostating, both located in and under the jurisdiction of the engineering department. This centralizes the work. Very often, on small orders for tracings for example, photostats are preferable to blueprints, because of the fact that it is always expensive to start up a large continuous process blueprint machine where the machine is not in constant operation. On important "rush" work, where the shop must be instantly furnished with part or tool drawings, the tracings cannot be set aside until a sufficient number have accumulated to warrant starting the continuous blueprint apparatus.

An excellent layout for a combined blueprint and photostat room which affords both efficiency and economy, is shown on the following page. It affords a continuous flow condition, whether the work be blue-

printing or photostating. On the left side, we have the tracings coming in from the tracing file to the table in the rear. Here they are fed into the blueprint machine and returned to that same table. The blueprints are rolled up on the "out" side of the machine where the entire roll can be brought over to the cutting table to be cut up and delivered through the door as shown.

The layout for the photostat work is equally effective. The operator stands at the point marked *X* to operate his machine, the work to be photostated being placed on the focusing table toward the front of the room. The exposure is made, the print is taken from the fixing



LAYOUT FOR BLUEPRINT AND PHOTOSTAT ROOM

bath at the rear of the machine, and placed in the washing tray directly beside the operator. This necessitates but very little movement on the operator's part during the entire process. After the print is properly washed, it is placed in the gas drier and transferred from there to the photostat cutting table, where it is in turn ready for delivery.

It is important that the windows directly behind the photostat machine be covered up with some opaque material, so that no light can come in contact with the sensitized photostat paper as it is withdrawn from the machine and before being placed in the fixing bath.

From the engineering department standpoint, one of the chief objections to centralizing both the blueprinting and photostating in the engineering department is that it will materially increase the operating expenses of that department, and force upon it an unnecessary burden. This can be successfully avoided with very little bookkeeping.

First of all, in the case of blueprints, it is necessary to determine upon the number of prints which are ordinarily issued during the month, covering new drawings, drawing changes, etc., and which are regularly distributed to the different departments of the plant in definite specified quantities. In addition to that, there will always be requisitions for prints covering special subjects, which should of course, be charged to the department originating the requisition. It is thereafter merely a matter of determining what the expenses of the blueprint room are, so that they can be allocated on a fair and just basis.

A list of the expenses of blueprinting will include blueprint paper, electric lamp maintenance, supplies, gas, electricity, wages and overhead, and to get the cost of making blueprints per month, the total of these items may be taken

Inasmuch as blueprints are in themselves relatively inexpensive, it involves less clerical work to always charge for an average tracing regardless of the size of the specific print requisitioned. To get a fair average it is only necessary to take the total expenses for the month chargeable against blueprinting as outlined above and divide that figure by the total number of good blueprints put through for the month regardless of size. This gives an average cost per print, which figure should be charged against that department to which the print goes.

Photostat Expenses

Photostats, on the other hand, are expensive, wherefore it is hardly fair to charge out as much for an 8½x11-in. print, as for one 17x22 in. when the material cost, an important item, is four times as great in one case as in the other.

Some of the expenses chargeable to photostating are mercury lamp maintenance, developing powder, fixing powder, dryer maintenance, gas, electricity, wages and overhead.

It will be noted that we have omitted the item of photostat paper. This is an item of very great importance, affording the largest part of the total cost of photostating. It is necessary, therefore, to determine the value of the paper contained in an 8½x11-in. sheet, a 11x17-in. sheet and a 17x22-in. sheet, the three standard sizes. This can be done by dividing the square inches in a roll by the number of square inches contained in each size mentioned above. This will give the maximum number of prints of each size possible from a roll of paper. The value of the roll divided by the number of prints of each size will give the paper material value in each size print.

Wastage in Photostating

An important point to remember, however, is that there is considerable wastage in photostating, the amount of the wastage depending upon the skill of the operator, the type of work, the time allowed for using care, etc. This percentage of waste can only be determined by keeping track of several rolls of paper and then determining how many good prints are obtained therefrom. This percentage of spoiled photostat paper in relation to the number of good prints can be figured and this percentage of waste added in each case to the net material cost of photostat paper as outlined in the paragraph above.

We are now in a position to take the general expenses as tabulated above, and divide them by the number of good prints turned out per month, regardless of size. To this flat unit figure should be added, the material cost of the photostat paper according to the size of the print. This gives us a definite chargeable rate for each size photostat. This unit cost need be checked up only once or twice a year as it will not fluctuate widely.

At the end of the month it is well for the engineering department to summarize the blueprint and photostat charges against the various other departments and notify the factory accounting department so that the proper debits and credits can be made. This procedure when followed out charges the work where it belongs with no undue burden on any department of the plant.

Machining a Worm Drive Carrier

By Fred H. Colvin
Editor, *American Machinist*

The second article of a series on building the Sheldon axle—Locating on mandrels for turning, boring and drilling—Fixture for accurate boring at right angles

THE carrier of the Sheldon axle, which is the support for the worm, wormwheel and differential, is a malleable-iron casting and weighs 144 lb. in the rough. Its general appearance can be seen from the views depicting the different operations.

After inspection, the carrier is supported by a mandrel carrying a cone in each end of the worm barrel. The cones on the mandrel have three raised portions, or ridges, by which the bore is centered, the construction being practically the same as that mentioned in connection with the turning of the rear axle housing in the previous article. A number of these mandrels are in use, being put into place while the machine work is being done on another carrier. The mandrel remains in the carrier during the first few operations.

The first machining operation is the turning of the carrier seat as shown in Fig. 1, on a Bullard vertical turret lathe. How the carrier is positioned by the ends of the mandrel fitting into V blocks, is shown at *A*. The carrier flange is supported when necessary, by screws or blocks from uprights, two of which are shown at *B* and *C*. Both the seat where the carrier fits the housing and the capped bearing for the wormwheel, are faced at this operation.

With the carrier still mounted on the mandrel it is transferred to the drilling fixture shown in Fig. 2. Here the mandrel positions the carrier by fitting between the two jaws shown at *A*. The plate *B*, carrying the drill bushings, is then put into position as shown, and the carrier flange is supported at the side by the screw jacks *C*. The alignment of the bearings for the worm gear is tested by the gage shown at *D*, which consists of a square bar having pins at each end that fit into the drill bushings, as shown at *E*. The bar also carries fingers *F* and *G*, which indicate whether or not there is metal enough to bore out to size.

After the holes are drilled in the carrier seat, an auxiliary bushing plate *A*, Fig. 3, is fitted into position for drilling the four holes for the studs holding the bearing caps. This auxiliary bushing plate is positioned by a tongue and groove which allows it to be placed on top of the main bushing plate in one position only. Fig. 3 also shows how the mandrel is used in positioning the carrier in the drilling fixture, and the pin-wrench nut which tightens the centering cone at one end of the mandrel.

After the carrier has been inspected and the holes tapped, the studs for the bearing caps are screwed in, as shown in Fig. 4. There is also shown a very convenient form of assembling block for work of this kind. The block consists of a circular plate *A*, having four tapered projections, three of which are shown at *B*, *C* and *D*. This plate is supported on a substantial cast-iron stand which is heavy enough to prevent undue movement under any handling it is likely to receive.

For the work shown, the carrier is simply placed between the four uprights, or prongs, so that they support the flange, and the housing for the worm drops down

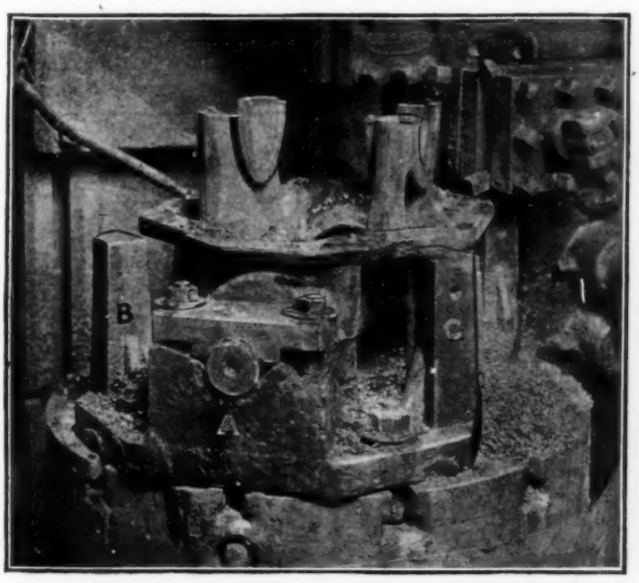


Fig. 1—Turning the carrier flange.

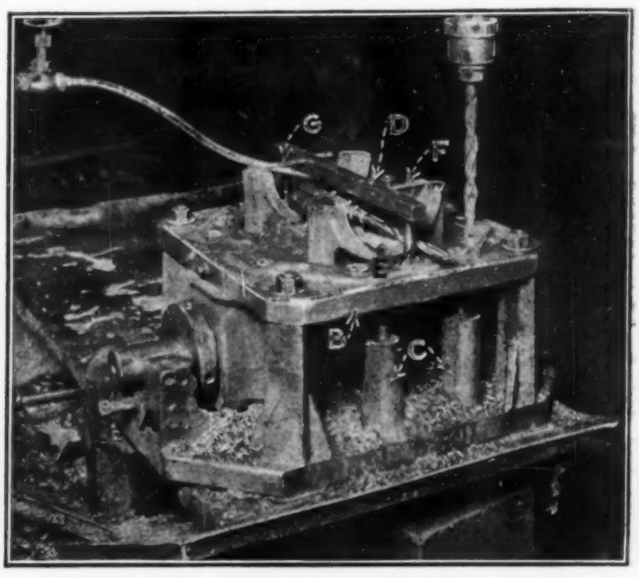


Fig. 2—Drilling the carrier flange

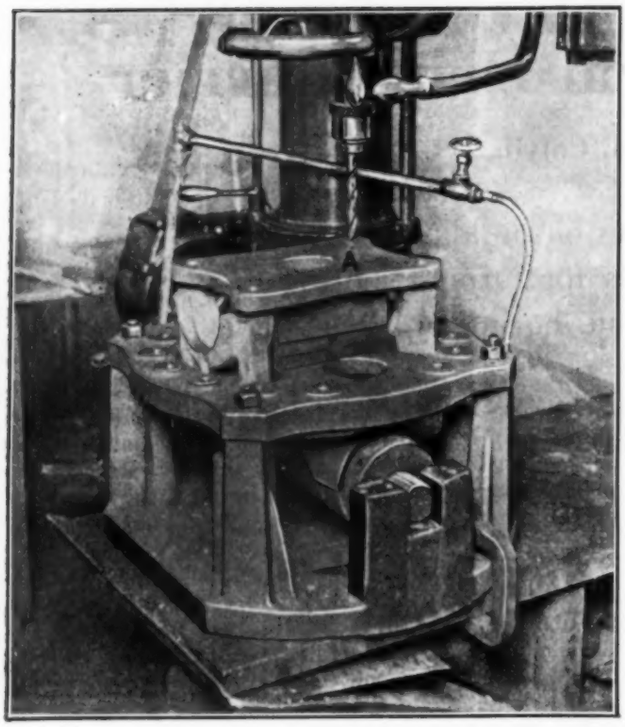


Fig. 3—Drilling for the bearing-cap studs

between them. They effectually hold the carrier in position and prevent turning as the studs are screwed in. The same stand is also very convenient for numerous other operations on the carrier. The worm housing, or the wormwheel bearings with the caps in place, can be placed over one of these prongs when it is desired to hold the carrier in other positions. It is a convenient method of handling an awkward piece.

After the bearing caps have been put in place the carrier goes to a horizontal boring machine which is equipped with the fixture shown in Figs. 5 and 6. In Fig. 5 the carrier is shown positioned by its flanged seat *A*, and is bolted into the upper part of the fixture through the flange holes. The upper part of the fixture is bolted to the base as at *B*. Both ends of the barrel are bored at this setting to receive the ball bearings in which the worm runs. The ball-bearing seats are bored with the cutters shown, by feeding the boring bar first in one direction and then the other.

It will be noted that the upper part of the fixture has a projection at *C*, and, just above it, a tongue *D*, with finished sides. Fig. 6 shows the upper part of the fixture reversed and the tongue *D* being lowered into the base of the fixture by means of a chain on the projection previously mentioned. Also shown in Fig.

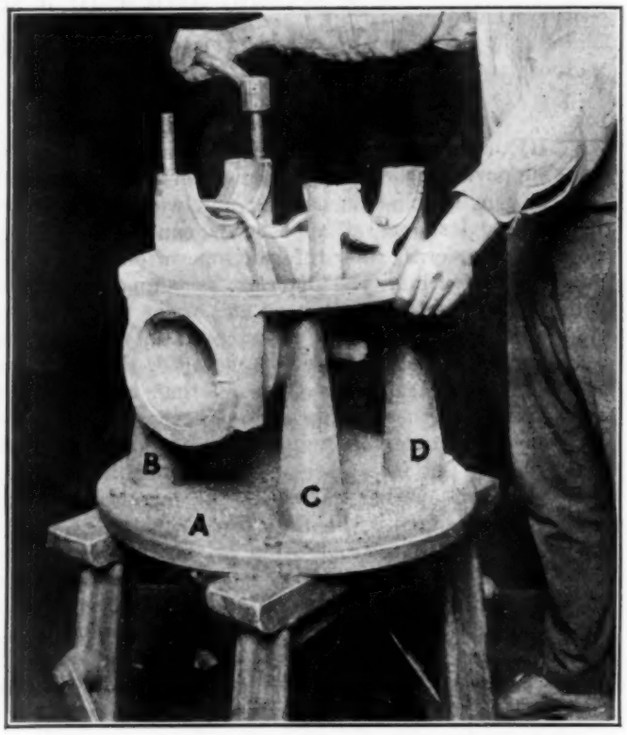
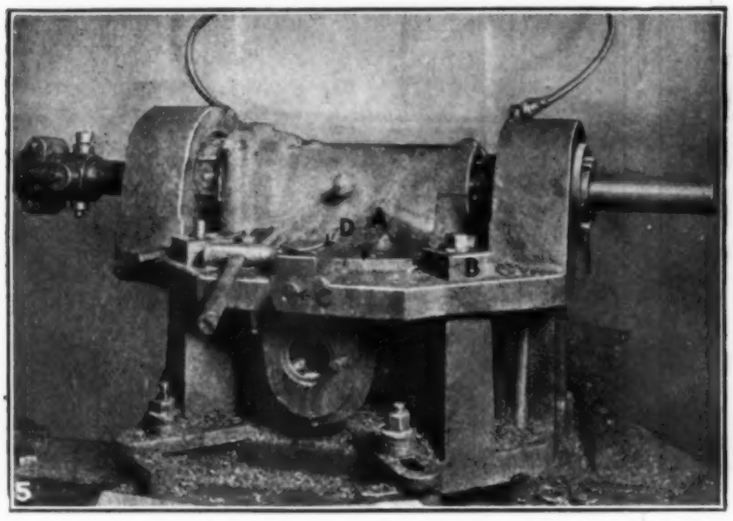


Fig. 4—Convenient stand for holding the carrier

6 is another tongue at *D*, by which the upper part of the fixture was located when in its first position. This system of tongues and grooves, together with a chain hoist conveniently placed, makes it possible to handle the carrier quite easily and to locate the two holes accurately at right angles to each other.

With the carrier in the position shown in Fig. 6, the seat for the bearings which carry the wormwheel



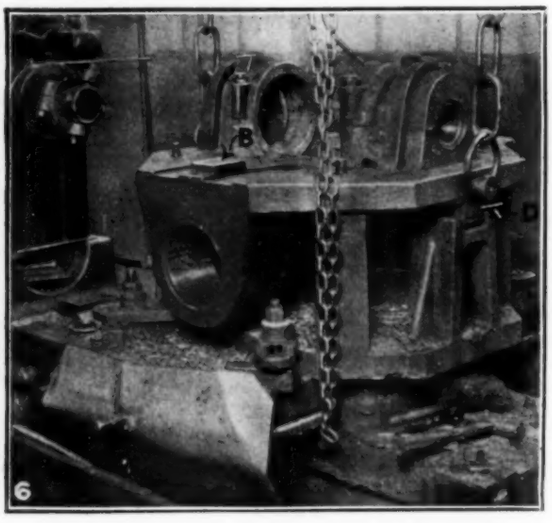


Fig. 5—Boring the bearing seat for the worm. Fig. 6—Fixture reversed for boring the worm wheel bearing

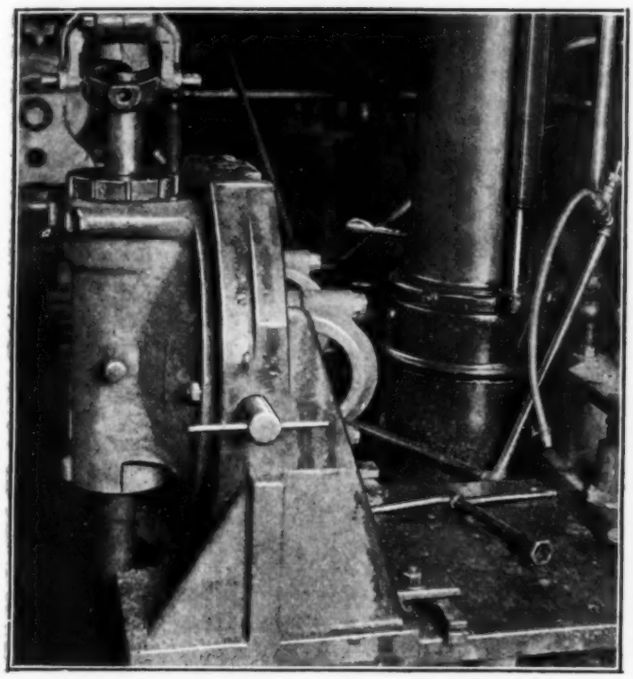


Fig. 7—Reaming the worm bearing

are bored in much the same manner as the bearing seat for the worm, shown in Fig. 5. Similar cutters are used and the boring bar is driven through a universal joint in both cases, so that the accuracy of the work depends entirely upon the fixture.

Following the boring, the bearing seats are reamed, as shown in Fig. 7. A universal joint allows a radial drilling machine to be used for this work and at the same time secures what is practically hand reaming. The carrier is held in an indexing fixture, and rotated 180 deg. in order to ream the bearing seat at the other end of the worm barrel. The seats for the wormwheel bearings are reamed in the same way in a similar fixture.

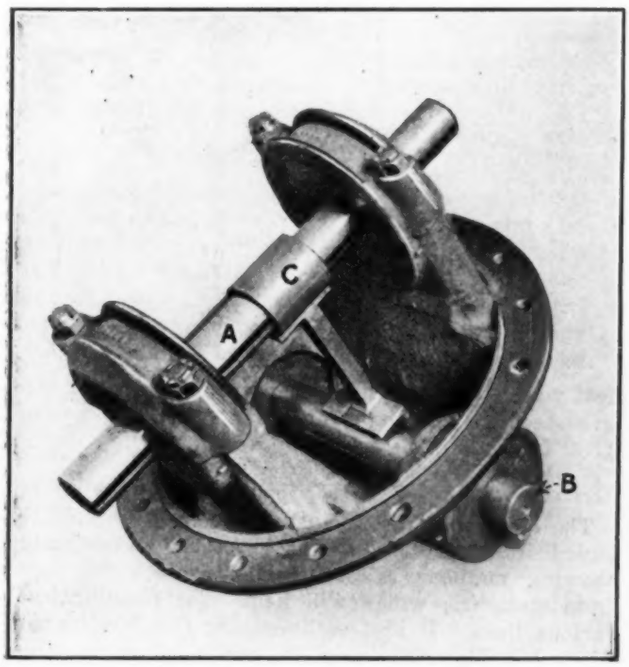


Fig. 8—Testing squareness and center distance

Before the carrier is sent to the assembling department it is thoroughly inspected. Fig. 8 shows the method of testing the squareness as well as the center distance of the two bearing seats which are at right angles. Test bars *A* and *B* are centered in their respective holes by suitable bushings, as shown. Bar *A*, in being pushed into place, goes through the hub of the arm *C*, which has a long bearing on it.

The other end of arm *C* has an angle plate several inches long, which tests both the squareness of the two shafts and their center distance. The length of this angle plate as it slides down beside shaft *B*, shows any deviation from squareness, the amount being determined by feelers. The upper leg of the angle plate is cut on an arc, so that it can be swung over the shaft and so test the center distance.

The Old Time All Around Machinist

By F. M. A'Hearn

The frequent references to the resourcefulness and ability of the "old time all around machinist" who, according to tradition and anecdote, must have been at his best during the last quarter of the past century, and, if we are to believe what is written, is now rarely found outside of the pages of shop history, must tend to disconcert the younger mechanics. They can scarcely hope to have their praises sung in years to come as is the case when describing the many wonders performed by the old timer. In fairness to these ambitious young men it would be right to state that, in addition to the wonder workers described from time to time, there were also present among the ranks of mechanics of the period mentioned, a goodly number of dubs who did nothing out of the ordinary unless it was to make absurd blunders. Why then, in talking over old times, not be fair and add that the heroes of our stories were men of more than average ability in their day and age.

Older readers of the *American Machinist* will remember the letters by A. P. Press who contributed some live comments back in the nineties. He related one in particular, of a journeyman clamping a pulley to the face plate of a lathe without clearance at the inner end of the hub and roughing out the cored hole with the flat drill, incidentally boring away the nose of the spindle of the lathe and dropping faceplate and job to the floor.

Another one, a favorite of the times, was to attempt to increase the pitch diameter of a gear and retain the original number of teeth. That seemed to be a sort of hobby for I saw it tried by two old time "all arounders" in different shops. A first year apprentice in any progressive shop today can size a gear blank if given the number of teeth and pitch, but just try to determine the pitch or shape of tooth from a dozen of the old timers' wood patterns for cast gears.

To anyone mourning the passing of the "old time mechanic" the writer would suggest reading Jim Skeever's "Object Lessons," written by the late John A. Hill and published in book form in 1899. He will find that tools and equipment have changed since that date more than have men. In addition to this, remember that when only one machinist or one blacksmith lived in a community nothing developed in the way of comparison and he could pose as a mighty man and get away with it, in a manner similar to that used by a surviving "old timer" safe from contradiction.

Advertising Steady Employment

BY JOHN T. BARTLETT

Twenty-four years without a "lay-off" is a real record for any industrial enterprise. A company which could point to such ought to make a good employer to work for. When a local newspaper at Appleton, Wis., put on one of those "special development" editions which are periodically epidemic, the Appleton Toy and Furniture Co. took space, as loyal manufacturers always are expected to, but it got real, constructive benefit from its advertising, because it realized that even in the home town there is advertising which a progressive manufacturing concern can use to advantage.

The advertising was not to sell its products, but to sell itself as a good place to work. What the company did was to run an advertisement which declared the fact above mentioned, "TWENTY-FOUR YEARS WITHOUT A LAY-OFF." Then it went on to say:

"Such is the service status of some of our present employees.

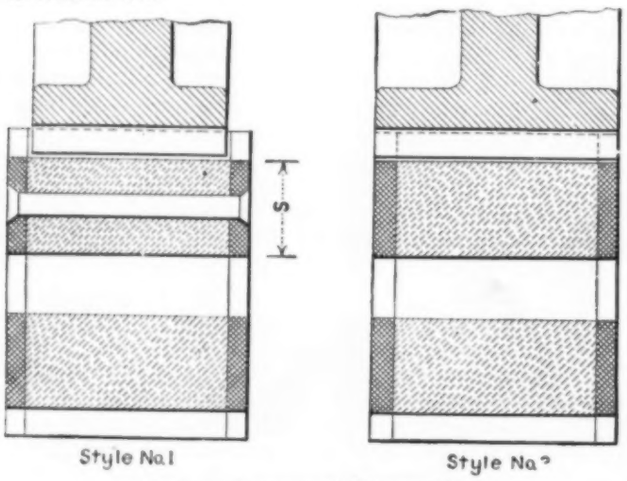
"In spite of business panics, depressions and strikes that, during the past twenty-four years have affected the entire business and industrial world and caused factories and industries to lay idle for months, we have been able to maintain our employees year after year at steady employment."

Following this came a "roll call" of employees, classified by length of employment with the company. There were six in the "20 years and over" class, three in the "10 to 20 years," seven in the "4 to 10 years," and sixty in the "less than 4 years."

While some industrial concerns could not use the same good-will building material, most that are successful and progressive in relations with employees have facts that would make effective advertisements. More than the ends of "policy" are served—a direct bid is made for the better workers of the community.

Adopted Standards for Non-Metallic Gearing

This subject covers gears made of rawhide. In the attempts at standardization of this class of material, there has been kept in view the idea of giving the designer something that will aid him to select and lay out a pinion of proper proportions with the least amount of calculation.



Styles of non-metallic gearing

Tables I and II and the chart have been plotted for regular shop practice and give all necessary details and are self-explanatory.

For circular pitch, use equivalent diametrical pitch.

Table I—Dimensions for Non-Metallic Gears

Diametral Pitch	Minimum Value of "S"	Thickness of Brass Retainers: Style 1, 12 to 20 teeth	Style 1, 21T and Over	Style 2, 12 to 16T	Style 2, 17 to 25T.	Style 2, 26T and over	Diam. of Rivets: 12 to 23T	24T and Over	Style 1—Face of Rawhide Additional to Face of Metal Mate
1	3		1		1	1¼			
1¼	2⅜								
1½	2						1/16	1/16	1/16
1¾	1 11/16								
2	1½	1/16		1/16				1/16	
2½	1 3/16						1/16		1/16
3	1								
4	¾						1/16		
5		1/16	1/32	1/16	1/32	1/32			1/16
6	½	1/32		1/32			1/16		
7			1/16		1/16	1/16		1/16	1/16
8	⅜	1/32		1/32			1/16		
10	¼		1/32		1/16	1/16		1/16	1/16
12	⅛	1/32		1/32			1/16		

Pinions made with hubs (bushings or spiders), or with steel or cast iron flanges are special construction.

For strength and economical service, pinions should be made with not less than 15 teeth.

To avoid charred condition of the rawhide caused by heat generated through friction when operated at excessive speeds, a maximum pitch line velocity of not over 2,500 ft. per min. is recommended.

Table II—Number of Rivets

No. of Teeth	1 to 4 Pitch	5 to 6 Pitch	8 to 12 Pitch
12	5	5	4
13	5	5	4
14	5	5	4
15	5	5	5
16	5	5	5
17	5	5	5
18	5	5	5
19	5	5	5
20	6	5	5
21	6	5	5
22	6	6	6
23	6	6	6
24	6	6	6
25	6	6	6
26	6	6	6
27	6	6	6
28	7	6	6
29	7	6	6
30	7	6	6
31	7	6	6
32	7	6	6
33	7	6	6
34	7	6	6
35	7	6	6
36	8	7	7
37	8	7	7
38	8	7	7
39	8	7	7
40	8	7	7

The Metropolitan Life Insurance Co., New York, has issued Business Leaflet No. 3, on the Sales Budget, showing methods of securing desirable information from statistics, which will help sales possibilities in various lines. It also outlines how the Westinghouse Electric & Manufacturing Co., and a large automobile company establish their sales quotas.

How to Select a Spring Material

By Joseph Kaye Wood
Chairman, A. S. M. E. Special Research Committee on Spring Design

A quantitative method for determining a proper spring material—Load deflection rate—Effect of temperature on modulus of elasticity—Maximum safe range of deflection

PRESENT day practice in the manufacture of springs used in watches, measuring instruments, power control mechanisms, automatic telephone equipment, automobile and railway car suspensions, etc., requires materials having high spring quality. In some cases special properties are also required such as, good electrical conductivity, resistance to corrosion, and elasticity at high temperatures, and these very often do not permit the selection of the material having the highest spring quality. The question therefore naturally arises, what properties must a material have, irrespective of special requirements, in order to be most suitable for springs.

If we are to be guided by the still prevalent notion that springs are merely coiled pieces of wire or strips of sheet metal, we probably would answer that a spring material should be highly elastic and durable and, with a little further consideration, we might add that such a material should also have good fatigue and shock resisting qualities. However, these purely qualitative answers do not offer any definite and immediate help to the engineer seeking the proper material for a spring he is designing, because so many materials are "highly elastic" and the choice is often limited by special requirements which necessitate some quantitative method of comparison. Therefore, it is the writer's purpose in this article to explain the quantitative method developed by him for the solution of hundreds of spring problems brought to his attention.

Spring Quality Factors

Spring quality may be gaged by two principal quantities, the load-deflection rate and the maximum safe range of deflection, each of which is discussed below, first without the limitations imposed by special requirements, and second, with these limitations.

When a piece of elastic material is stressed, the deflections are found to be proportional to the corresponding loads, provided the proportional limit is not exceeded. Referring to the chart, showing the graph of this relation, the slope, tan θ, is equal to the load-deflection rate in lb. per in., which are the units assumed throughout the remainder of this article. The relation of this rate to the dimensions of the piece of material is given by the general deflection formula which is as follows:

$$\text{Load-Deflection Rate} = \frac{P}{F} = k\rho E \qquad (1)$$

where E is a general modulus of elasticity whose value depends upon the material and the method of stressing, which may be tensile, flexural or torsional; ρ is the ratio of the cross sectional area to the length; while k is a factor depending upon the method of stressing, the cross sectional form and the proportioning of its dimensions.

The value of k for pure tension is unity, while for all other methods of stressing, it is less than unity, due to the lower average unit stress for a given maximum unit stress. The stresses in springs are necessarily flexural and torsional, because they give the lower load-deflection rates which are more suitable than the higher rates obtained with tension. Further lowering of these rates, which means decreasing the stiffness of the spring, is brought about by coiling the piece of material either helically or spirally. In practice, E for flexure may be considered as being equal to Young's modulus, and in the case of torsion E is equal to this modulus modified in accordance with Poisson's ratio, which usually gives a value about equal to 0.4 of Young's

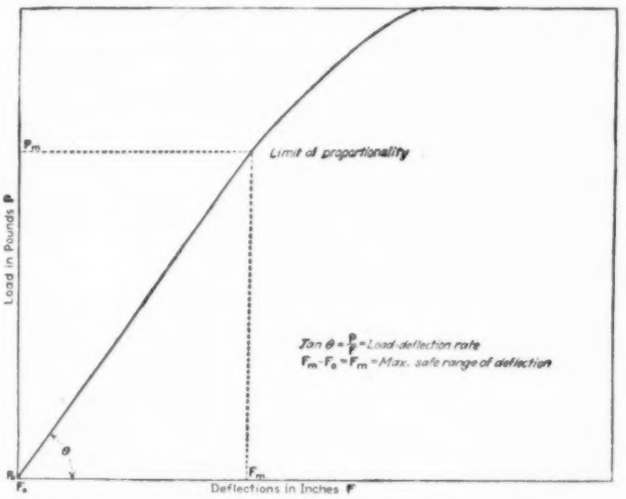


Chart showing relation graphically between load-deflection rate and maximum safe range of deflection

modulus. In some cases the torsional modulus and the other moduli are obtainable directly from tables; in other cases they must be determined experimentally.

Therefore, in the selection of a spring material from the load-deflection rate standpoint, we need only to compare Young's moduli for the materials available, because formula 1 shows that for a given form and size of spring the symbols k and ρ cancel out, and in the case of torsion Poisson's ratios will not be appreciably different. The

table, which lists various metals and their moduli of elasticity, shows that a selection of material may be made having a modulus anywhere from 6,000,000 to 30,000,000 lb. per sq.in. Thus a steel spring having a modulus equal to the latter figure would have a load-deflection rate about twice as great as a phosphor bronze spring similar in form and size and having a modulus equal to 16,000,000 pounds per square inch.

Very few conditions appreciably affect the value of Young's modulus for a given material, and even these to only a slight extent. Steel, with its wide variation in microstructure, due to variations in carbon content, heat treatment and cold working, has a modulus which differs only slightly from the value given in the table. Of course, in the case of a high nickel chrome steel, which has only about a 60 per cent iron content we will find a noticeably different modulus. Similarly in the non-ferrous alloys, we would expect also to find an appreciable variation in the modulus, due to a wider variation in the composition. In general, so far as composition, and possibly cold working, are concerned, we may say that if the variation in the constituents or compactness is sufficient to change the density appreciably, then the modulus will also be changed appreciably.

The table shows that except for the break made by the copper alloy series the modulus tends to vary directly with the density.

The slight deviation from proportionality between stress and strain produced in a specimen by overstrain, may cause slight inaccuracies in the plotting of the stress-strain curve and consequently in the modulus of elasticity. Temperature or low temperature annealing would cure this imperfect elasticity, allowing a more accurate determination of the modulus which, when compared with the value previously determined, would show slight differences. Moduli determined for specimens having the direction of rolling oriented differently, may also show differences, as will be readily understood.

Probably the greatest variation in the modulus for a metal of a given composition is produced by variations in the surrounding temperature. Thus, the modulus for steel is reduced about 10 per cent by elevating the surrounding temperature from about 70 deg. F. to 300 deg. F. This fact should be taken into consideration, especially when designing springs for steam and gasoline apparatus such as turbines and reciprocating engines.

Therefore, the only quantities influencing the choice of a spring material from the load-deflection rate standpoint, without the limitations imposed by special requirements, are the relative values of the moduli of the materials at hand. Special requirements which limit this selection are space limitations, which pin the designer down to a spring of definite size; low density, which is important in aeroplane construction and for oscillating springs; corrosion; high operating temperatures; and large maximum safe range of deflection, which we will now consider.

The maximum safe working stress used in machine design calculations is usually determined by dividing the ultimate strength of the material under consideration by a "factor of safety." This factor is estimated by judgment based upon the possible maximum service conditions to be expected; upon the unknown properties of the materials, such as resistance to fatigue and shock failure; and finally upon the commercial variations of the known properties. To further increase the margin of safety, it is often the practice to use a material with considerable ductility. However, this property is usually accompanied by low strength, which accounts for the rapid growth of the use of alloy steels having both high strength and high ductility.

The proportional limit not being considered in ordinary machine design calculations of the maximum safe

Values of Material Index and Other Properties for Various Metals

Reference Number	Material	Form of Material	Density in Lb. per Cu.In.	Young's Modulus in Lb. per Sq.In.	Proportional Limit in Lb. per Sq.In.	Material Index (Static)	Endurance Limit in Lb. per Sq.In.	Material Index (Kinetic)	Tensile Strength in Lb. per Sq.In.	Ult. Elongation % in 2 in.	Percentage Reduction in Area
1	Magnesium alloy (Zn—4%)	Bar	0.065	6,000,000	6,000	0.0010	.....	.....	36,000	17	20
2	Duralumin	Bar	0.100	10,000,000	25,000	0.0025	.....	.....	50,000	16	50
3	High nickel-chrome steel	Rolled sheet	0.218	27,000,000	100,000	0.0037	.....	.....	127,000	50	55
4	High nickel-chrome steel	Cold drawn wire	0.220	28,000,000	180,000	0.0064	.....	.....	220,000	12	..
5	Chromium steel	Rolled sheet	0.278	29,000,000	150,000	0.0052	.....	.....	185,000	15	35
6	Low nickel-chrome steel	Bar	0.280	30,000,000	115,000	0.0038	.....	.....	138,000	18	62
7	Spring carbon steel (1.0% C.)	Rolled sheet	0.280	30,000,000	152,000	0.0056	.....	.....	168,000	11	..
8	Carbon steel (1.20% C)	Bar	0.280	30,000,000	120,000	0.0040	92,000	0.0036	180,000	9	15
9	Steel music wire	Drawn wire	0.285	30,800,000	260,000	0.0084	.....	.....	310,000	8	..
10	Silicon manganese steel	Bar	0.282	30,000,000	100,000	0.0033	65,000	0.0022	157,000	16	40
11	Spring molybdenum steel	Sheet	.....	30,000,000	215,000	0.0071	.....	.....	225,000	14	40
12	Nickel steel	Bar	0.280	30,000,000	82,000	0.0027	63,000	0.0021	112,000	24	60
13	Pure tungsten	Small drawn wire	0.720	60,000,000	370,000	0.0061	.....	.....	490,000	..	..
14	Brass (Zn—35%)	Rolled sheet	0.307	12,000,000	40,000	0.0033	.....	.....	60,000	25	30
15	Phosphor bronze (8% Tin)	Rolled sheet	0.312	16,000,000	70,000	0.0044	40,000	0.0025	90,000	9	..
16	Nickel silver (Ni—18%, Zn—12%)	Rolled sheet	0.320	17,000,000	65,000	0.0038	.....	.....	90,000	3	33
17	Monel metal	Rolled sheet	0.320	23,000,000	50,000	0.0022	.....	.....	94,000	30	35

stress, permanent set may or may not take place. If it does, the small displacement of the material is usually not detrimental to the proper functioning of the machine, but on the other hand, there are some types of mechanisms in machine design, and this is particularly true of springs, in which displacement of material due to permanent set is often detrimental. For this reason, the maximum safe working stress is usually based upon the proportional limit in spring design, and for the present we shall consider the safe stress as being equal to this limit, after which the manner of allowing for the unknown factors such as fatigue, impact, etc., will be explained.

Referring to the chart, the load P_m produces a stress equal to the proportional limit. This means that the corresponding deflection F_m is the maximum amount that the material may be displaced without causing permanent set. Hence F_m is designated as the maximum safe range of deflection. The relation of this range to the spring dimensions and other important factors is as follows:

$$F_m = \eta \, l \, \frac{S}{E} \qquad (2)$$

In this expression $\frac{S}{E}$ is the material index,[1] a pure number whose value depends entirely upon the kind of material, as it is obtained by dividing S, the maximum safe working stress, by E, the modulus of elasticity; l is the length of the material; while η is a factor depending upon the method of stressing and the proportioning of the dimensions. In pure tension η is equal to unity and for all other methods of stressing it is greater than unity. Incidentally, it is interesting to note that in the case of pure tension the maximum safe range of deflection is equal to the material index multiplied by the length in inches. The best available spring material (steel music wire) has a material index about equal to 0.008 in., which in pure tension would give a very small deflection range unless the material were made too long to be practical, which is another reason why springs necessarily have their principal stresses of the flexural or torsional type. In addition to a higher value of η, the latter types of stresses permit long lengths of the material to be coiled spirally or helically, thus taking up less space. In this way the deflection range is greatly increased and an increase in the usefulness of the material in the spring results.

Therefore, in order to compare spring materials from the maximum safe range of deflection standpoint, all we need to do is to compare the material indexes, because formula 2 shows that for a given form and size of a spring all other quantities cancel out. To determine the material index of a material it is necessary to know both the value of the modulus E, which was previously considered in connection with the load-deflection rate, and the value of S, the maximum safe working stress, which will now be considered.

The value of S varies over a very large range due to many conditions, such as slight variations in composition, heat treatment, cold working, surrounding temperatures, etc. Greater care, therefore, should be exercised in ascertaining the correct value of S than in finding the value for E for the computation of the material index because, as pointed out previously in our consideration of the load-deflection rate, the value of the modulus E varies but slightly under these different conditions. The value of S in torsion is generally equal to about 0.6 of the value of S in flexure or tension. In any case for an accurate comparison of different metals, the values of S and E should not be used unless they actually represent the metals under consideration. The table, which gives these values for tensile stressing along with the corresponding material index and other properties, should be used only for general purposes, as the figures were collected from many diverse sources.

Up to this point we have assumed the working stress S to be equal to the proportional limit, which does not provide any margin of safety against permanent deformation and fatigue failure. The latter type of failure in the case of stress reversals very often takes place below the proportional limit, hence the manner of allowing for this important phenomena will be discussed first. In the strict theoretical sense, the assumption that the proportional limit is the value to substitute for S in regard to fatigue is probably correct, as recent fatigue investigations indicate that the endurance limit, i.e. the maximum stress which will not cause progressive failure, corresponds to a "true" proportional limit which can only be determined statically by very refined methods. However, Gough[2] of the National Physical Laboratory in seeking to shorten the long drawn-out fatigue tests found just such a "true" proportional limit by plotting a stress-strain curve in which the loads and deflections were measured while the specimen under test was going through rapid reversals of stress. Likewise Stromeyer[3] found this limit by plotting gradually increasing stresses against the corresponding temperatures resulting from the heat generated in the specimen, while it was being put through rapid reversals of these stresses. Both of these methods gave stress values which agreed very closely with the endurance limits determined on the same materials by prolonged fatigue tests. Although we aim in ideal spring design to have pure elastic action throughout the maximum safe range of deflection F_m, this cannot be fully assured until the present fatigue investigations going on in various countries, principally in England and the United States, have determined the endurance limits for most of our spring metals. However, where a spring is not deflected more than, say one million times, it is not really essential in most cases to have a pure elastic range, inasmuch as the ordinary proportional limit determined with the present day type of testing machine is sufficiently accurate to limit the safe deflection range. In fact, if the "true" limit were to be occasionally exceeded in service, i.e. if the spring is only occasionally overstrained, an apparently new and slightly higher limit is established which increases the allowable deflection range.

Static and Kinetic Values for Material Index

In view of the above considerations and the fact that the "true" proportional or endurance limits of those metals, for which the fatigue investigations have shown such limits to exist, do not bear any definite relation to the statically determined proportional limits, the writer has suggested[4] that the material index be divided into two types, the "static" index, to be used in spring design where the number of deflections is less than one million and the "kinetic" index, to be used where

[1] This term was introduced in an article on the "Design of Helical Springs" by the present writer, published in *American Machinist*, Vol. 54, page 628.

[2] H. J. Gough, B. Sc.—Improvements in Methods of Fatigue Testing—*The Engineer*, August 12, 1921.

[3] C. E. Stromeyer—Memorandum of the Chief Engineer of Manchester Steam Users Association, 1913.

[4] *American Machinist*, Vol. 58, page 185.

the number of deflections is considerably greater than one million. The table shows the value of the static material index for each of the metals listed and of the kinetic material index for those metals whose endurance limits have been determined. The modulus is the same for both of these indexes, because fatigue apparently does not affect this property.

Both the modulus and the proportional limit are decreased appreciably when the surrounding temperature is increased but the proportional limit usually decreases to a much greater extent, giving rise to a decrease in the material index. The character of this variation would be different for different metals, which necessitates a special determination of both S and E at the temperature desired, in order to compute the material index. Indexes for both Monel metal and high nickel-chrome steels at 1,000 deg. F. are probably not less than 60 per cent of the indexes at room temperature, as compared with about 40 per cent for some ordinary carbon steels. Springs required to operate at high temperatures should be made of metals whose material indexes will not decrease too much.

In actual spring design there are additional factors which determine the maximum safe working stress, such as occasional overload, sudden loads, and impact loads, but which need not be considered in the comparison of two metals unless the material indexes are somewhere nearly equal in value. Then the metal having the greatest ductility as gaged by the percentage elongation or by such empirical tests as the Erickson and simple bending tests for flat spring materials, or by the swedging and twisting tests for springs made of wire and bar stock, should be adjudged the better spring material. This judgment should be further influenced by the ratio between the ultimate tensile strength and the proportional limit, and also by the percentage reduction in area and the impact test figure. In any case the ductility should be sufficient because plastic action distributes the stress uniformly, while sufficient strength will prevent breakage when local overstressing or impact loads take place.

Special Requirements and Summary of Factors

Special requirements which limit the selection of a spring material from the maximum safe range of deflection standpoint are space limitations, low density, corrosion, high operating temperatures, fatigue quality and load-deflection rate.

The above considerations show that the quantitative determination of a proper spring material is based on several factors, and these factors, together with suggestions for their use and comparison, are, for convenience, briefly summarized as follows:

1—Spring materials are compared principally by two quantities, namely, the load-deflection rate and the maximum safe range of deflection.

2—For the same form and size of spring the load-deflection rate varies only as the first power of the modulus of elasticity.

3—The modulus of elasticity for a given material varies but slightly under different conditions of manufacture and service, the greatest variation being due to a change in the surrounding temperature.

4—For the same form and size of spring the maximum safe range of deflection varies only as the first power of the material index, a pure number equal to the ratio between the proportional limit and the modulus of elasticity.

5—If the number of deflections that the proposed spring is to receive in service is not very great, say less than one million, then the "static" material index should be considered, in which the proportional limit is taken as the limit determined by the commercial type of testing machine.

6—If the number of deflections is to be enormous, say considerably greater than one million, then the "kinetic" material index should be considered, in which the "true" proportional limit, better recognized as the endurance limit, is used, provided such limit is known for the material in question.

7—The material index of a given material varies considerably with slight variations in composition, heat treatment, cold working and elevated temperatures, due mostly of course to the large effect these variations have upon the proportional limit, and in the particular case of elevated temperatures, to the added appreciable effect on the modulus.

8—When the material indexes of two materials are equal or nearly equal, the one with the greater ductility and higher ratio of tensile strength to proportional limit along with high reduction in area, should be selected as the better spring material. The ductility and tensile strength should be sufficient to prevent breakage in the case of overloads, sudden loads, and impact loads.

9—In the absence of any information on the fatigue endurance limits, the value of the "kinetic" material index should be based upon a stress obtained by multiplying the proportional limit by a factor consistent with past performances and good judgment.

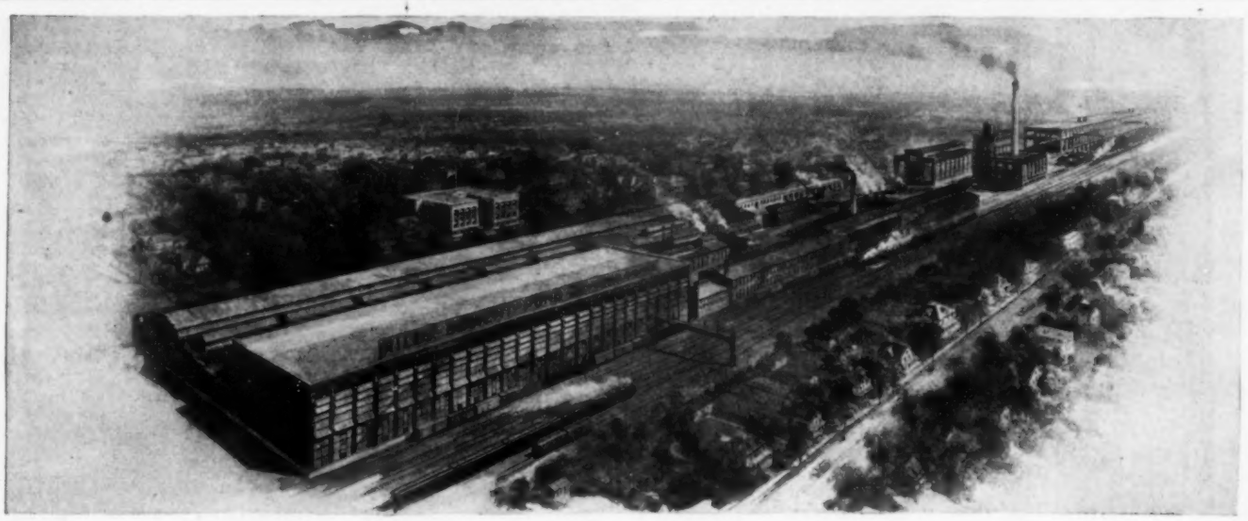
10—The table gives the values of Young's modulus, the material index, and of other physical properties for various metals which might be used for springs. These figures enable a comparison of the different metals with respect to the load-deflection rate and maximum safe range of deflection. In connection with the figures in this table it should be borne in mind that they do not, in every case, represent the best quality which can be obtained in practice. For example if brass were to be rolled to a higher temper, giving say a percentage elongation of 25 per cent instead of a per cent as shown in the table, then the proportional limit would be raised to very near that of phosphor bronze, giving 9 per cent elongation. The modulus being affected only slightly in producing this temper, and being lower for brass than for phosphor bronze, it might be possible to obtain higher material index for brass than for phosphor bronze. Although this would indicate that the former which is a cheaper material might be, in the most favorable circumstances, a better spring material, yet the greater stiffness, if desired, and higher tensile strength of phosphor bronze should not be overlooked.

Milling Cutters with Beveled Corners—Discussion

By John Mark May

Due to the fact that square cornered milling cutters frequently get injured on their corners to an extent that regrinding necessitates a reduction in either diameter or width that is far greater than would be necessary for any other reason and consequently have a shorter life, the remarks made in the article on page 724, Vol. 59, of the *American Machinist* under the title "What About Automobile Shops" regarding a 45-deg. bevel on the corner of large size cutters makes a strong appeal. I can see no reason why a standard cannot be adopted that could be used to an ever growing extent to the advantage of all concerned, and would suggest that the 45-deg. bevel at the corners be made sufficient to reduce the flat portion of the face on the size given and running upward to the next size shown as follows:

⅜-inch	cutter,	flat	portion	reduction	0.015 inch
½-inch	"	"	"	"	0.025 inch
¾-inch	"	"	"	"	0.040 inch
1-inch	"	"	"	"	0.060 inch
1¼-inch	"	"	"	"	0.080 inch
1½-inch	"	"	"	"	0.100 inch

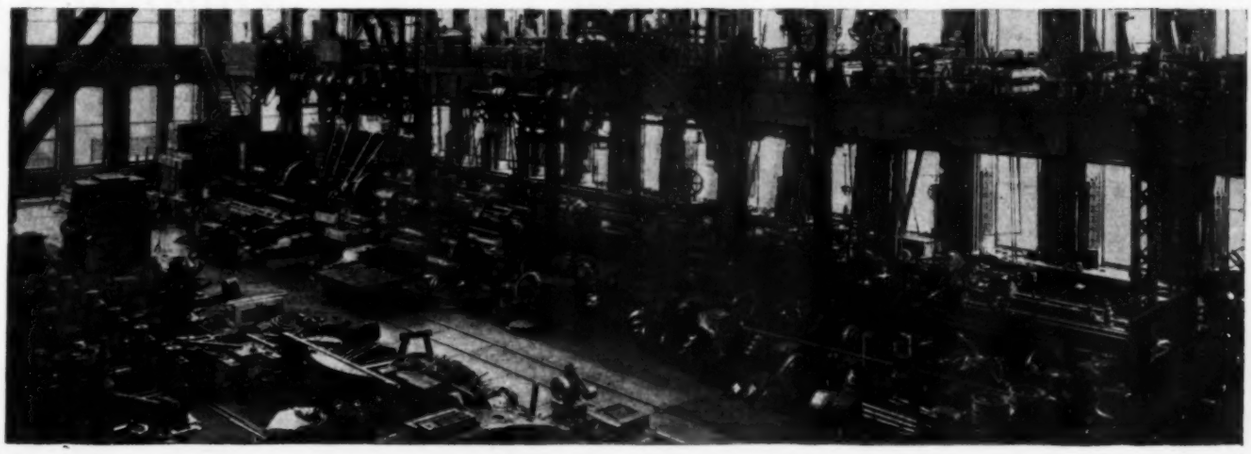


Pond Works, Plainfield, N. J. (Founded 1850)

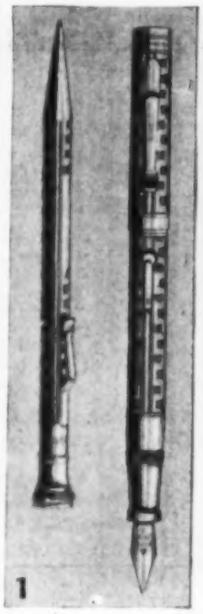
Where Machine Tools Are Made

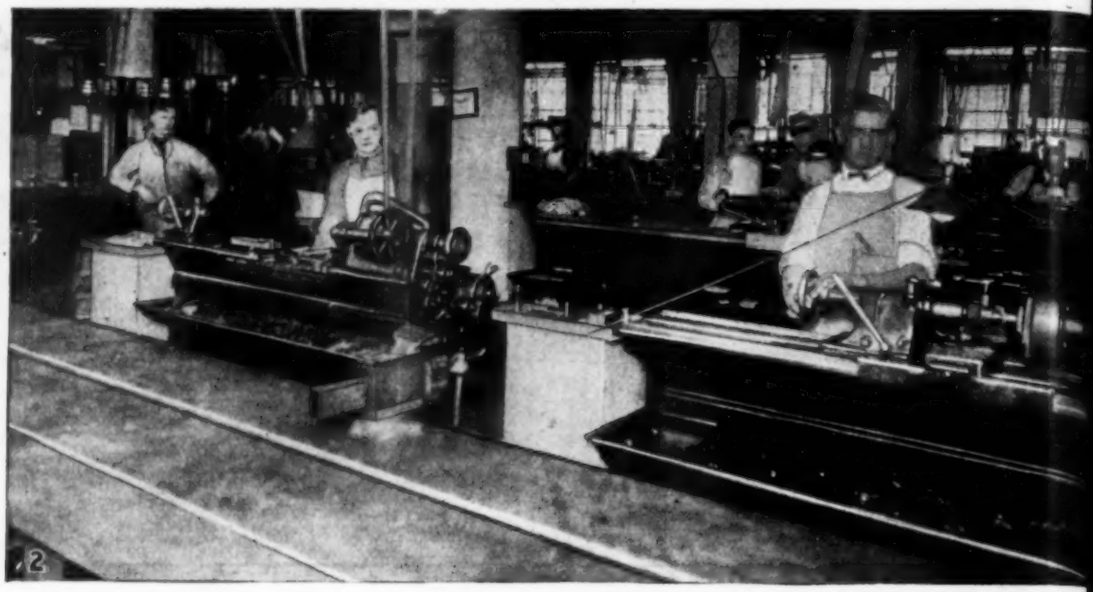
Niles-Bement-Pond Co.

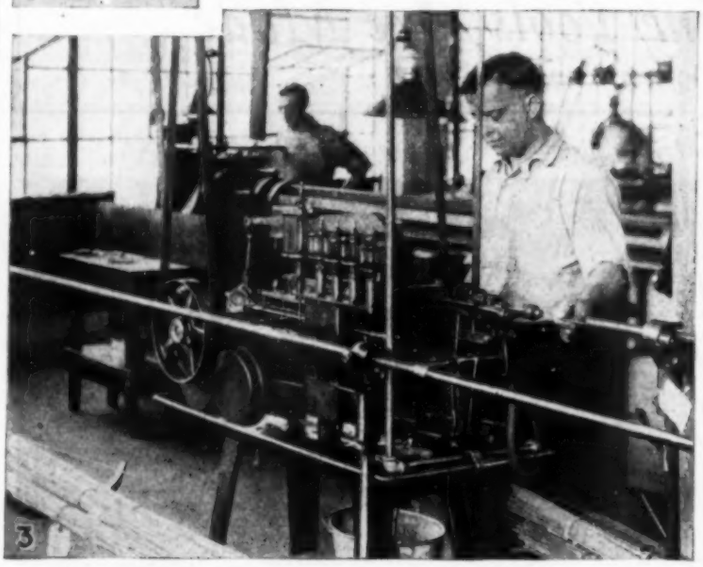
Interior View, Bement Works, Philadelphia, Pa. (Founded 1851)



Niles Tool Works, Hamilton, Ohio. (Founded 1852)







Machine Tool for

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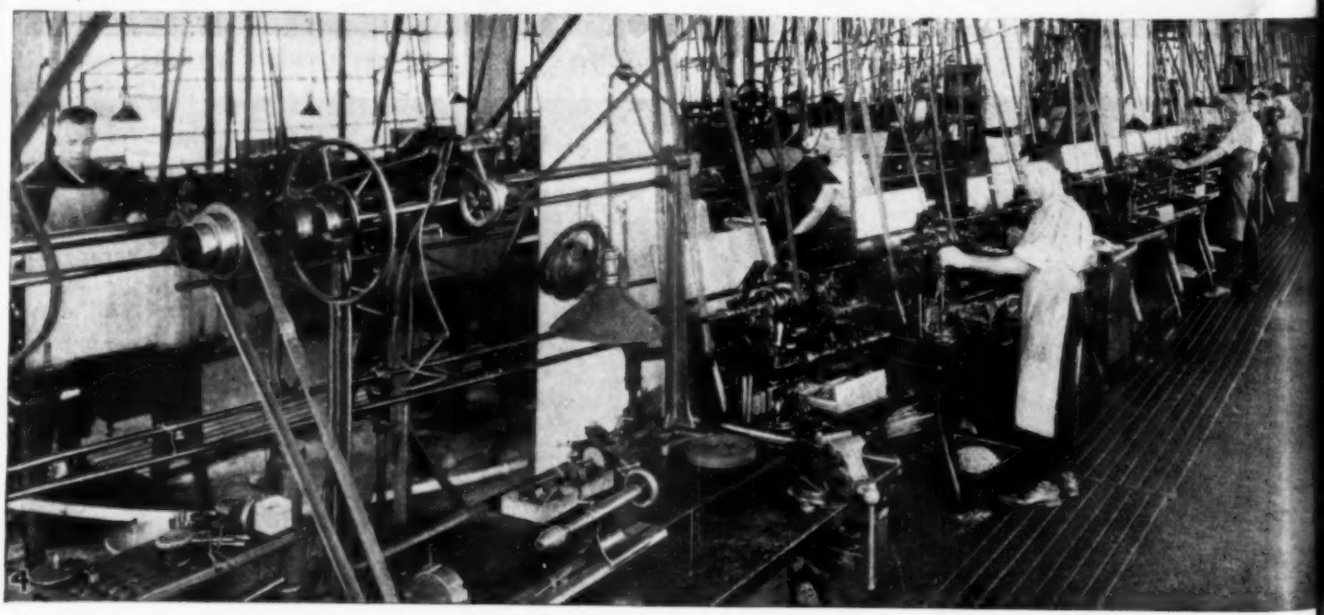
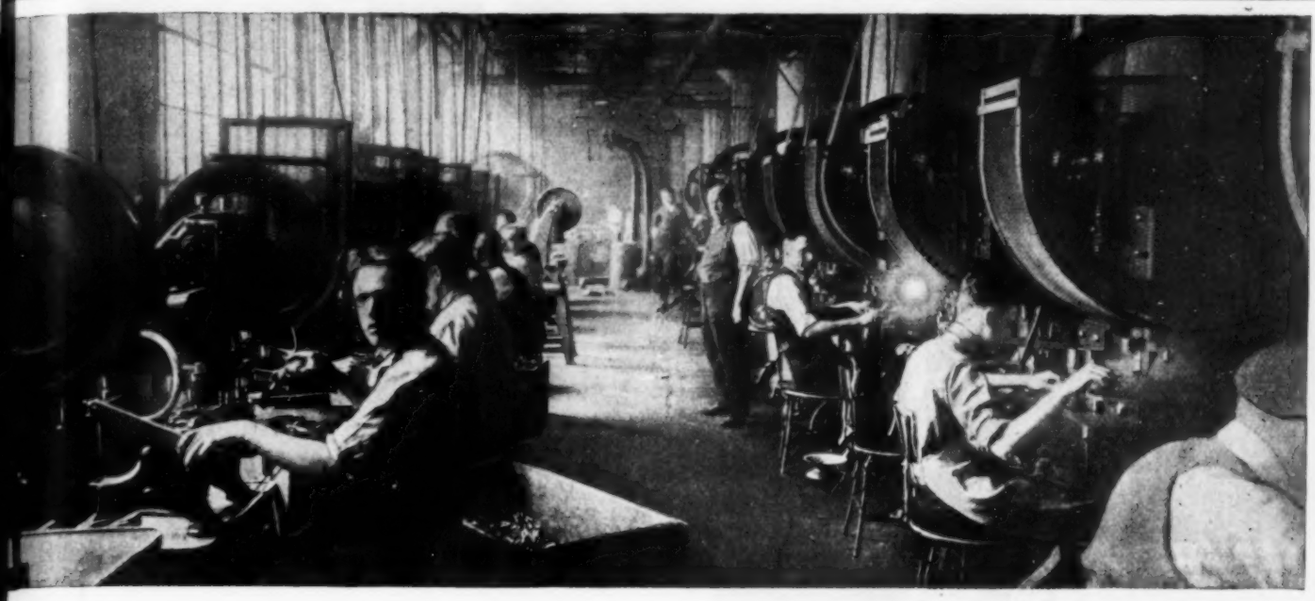
Fig. 1—Wahl pen and Eversharp pencil

Fig. 2—Tool room

Fig. 3—Cutting and forming pencil magazines

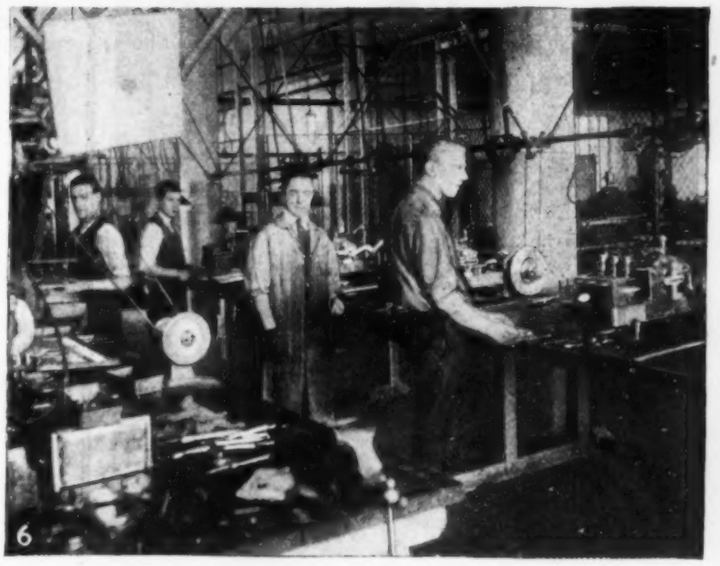


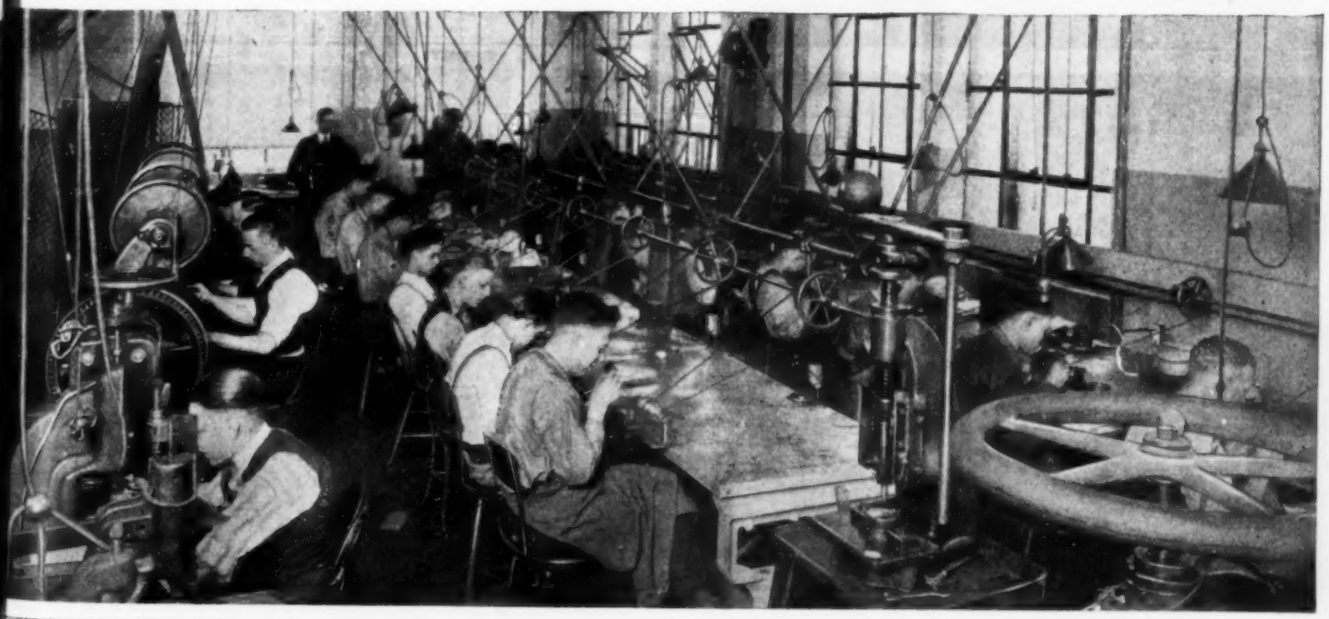


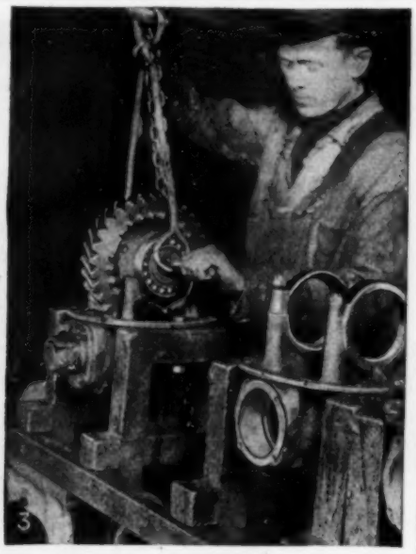
...or Writing Tools

...mpany's plant

Fig. 4—Screw machine department
Fig. 5—A battery of punch presses
Fig. 6—Engine turning designs on barrels
Fig. 7—Stamping and grinding pen nibs







Assembling Worm Drives

Sheldon Axle & Spring Works

Fig. 1—Using air motor to bolt worm gear to spider

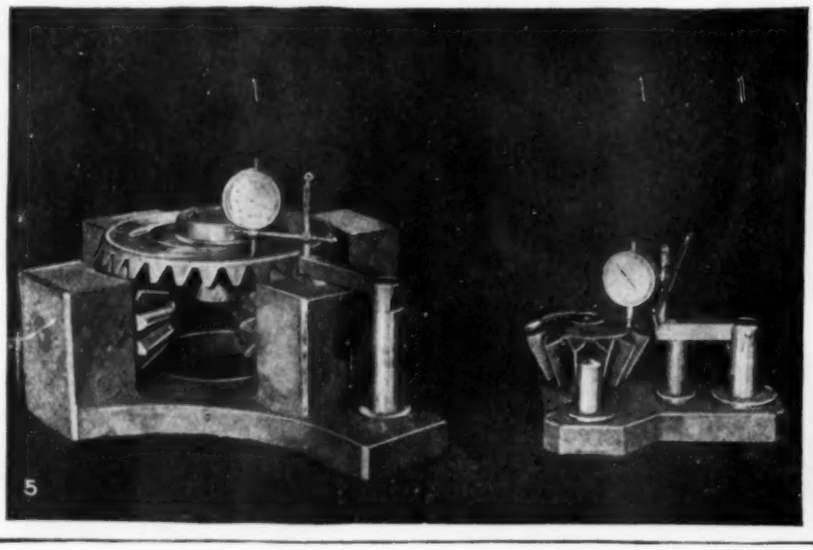
Fig. 2—Assembling bearing on worm before putting in place

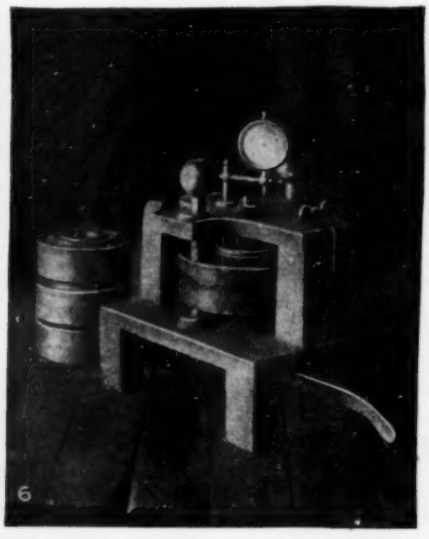
Fig. 3—Worm gear and bearing being lowered into carrier

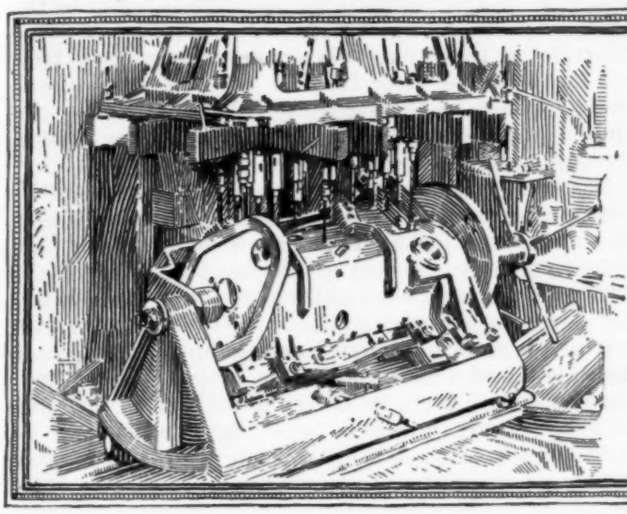
Fig. 4—Completed worm gear unit ready for axle

Fig. 5—Testing devices for inspecting differential gears

Fig. 6—Special inspection instrument for ball bearings







Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Use of cutting lubricants — Proper application of the coolant to the work—Lubricating arrangements for drilling, boring and turning—Special arrangements for turret lathes

IT FREQUENTLY happens that deep holes must be drilled from bar stock on a screw machine, either of the automatic or hand feed type. Work of this sort necessitates the use of an oil drill like that shown at *A* in Fig. 566. Drills of this kind are made by a number of manufacturers in both straight and taper-shank style, according to the kind of work for which they are required. The example given shows one of the oil holes in the cutting lip at *G*. The other end of the drill is shown in section in order to illustrate the

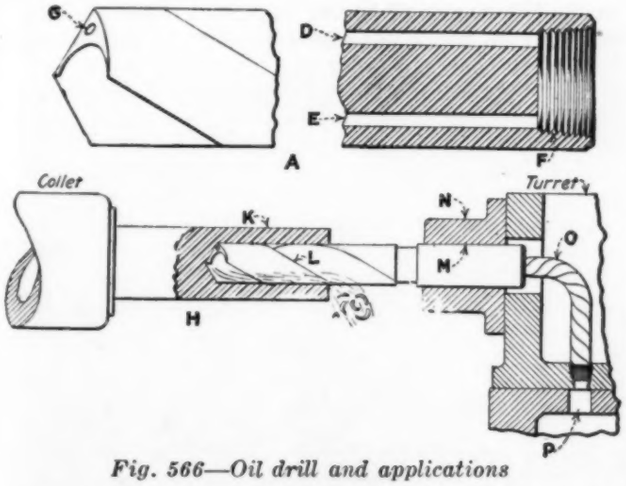


Fig. 566—Oil drill and applications

position of the oil holes at *D* and *E*. The hole *F* is sometimes made so that a standard pipe nipple will fit it, thus making an easy method of connection. It is evident that the holes are drilled before the drill is twisted. The common method of making the connection at the end *F* is by means of a nipple attached to a flexible pipe or to a standard pipe, according to the conditions governing the application.

As the designer of tools for turret lathes may often be required to design an equipment of tools which need special oiling arrangements, a few illustrations showing successful methods of application may be of interest. In the example shown at *H* the work *K* is a piece of bar stock, held in a collet in the usual manner, and to be drilled by an oil drill *L*. The shank of the drill *M* is held in a regular drill holder *N*, located on the turret of the machine. A flexible-tube oil connection is applied, according to the provision for oiling with which the machine is supplied. In the example shown, the oil comes up through the hole *P* in the turret slide, and makes connection with the flexible-tube connection *O* when the turret is indexed to the proper position.

All turret lathes are not provided with this system of oiling, but some similar provision can usually be made if ordered specially. If there has been no thought of special oiling arrangements when the machine was ordered, it will be necessary to resort to other methods, some of which will be illustrated and described here.

A short time ago the writers were obliged to design

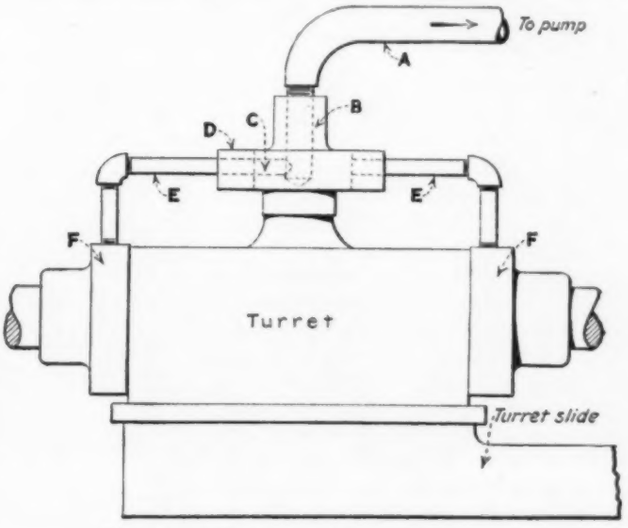


Fig. 567—Oiling attachment on turret

an equipment of turret lathe tools for working inside of a large steel casting. Boring bars and other inside cutting tools were long, and as a consequence ordinary methods of lubrication were practically useless. All the boring bars and internal cutting tools were provided with oil holes or oil channels to lead the stream of lubricant to the proper points, and the turret tool-

For the authors' forthcoming book. All rights reserved.

holders were specially made so that connections could be easily made. Fig. 567 gives a very good general idea of the arrangement. The flexible oil pipe *A* was supplied with lubricant from the regular pump on the machine, and it enters a distributing collar *B* on the top of the binding post of the turret. Outside and surrounding this collar is a sleeve *D* from which six

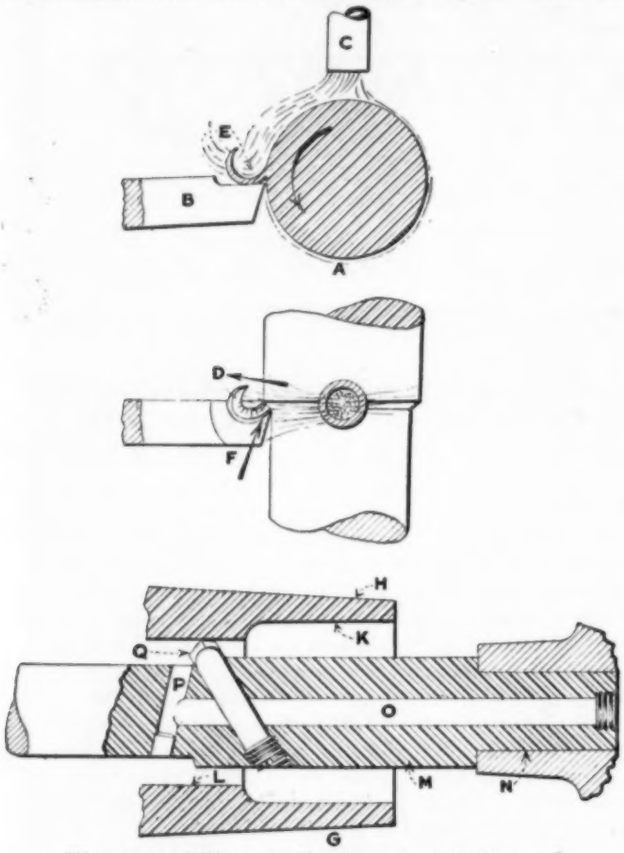


Fig. 568—Oiling applications to turning and boring operations

pipes *E* run to each toolholder *F* on the turret faces. As the turret is indexed the hole *C* in the distributing collar allows the oil to flow to only that tool which is in use at the time A similar arrangement can be adapted to different types of turret lathes and will be found simple, economical and effective.

A point of importance in connection with the design and application of special lubricating systems, is to make sure that a convenient provision for shutting off the lubricant is incorporated in the design, so that the operator can easily turn on or shut off the supply at will. If considerable pressure is used it may be found necessary to provide a by-pass to insure that no trouble will be caused by back pressure when the supply is shut off. Care should be taken to use suitable glands or packing nuts wherever moving parts which carry oil come in contact with or slide on each other. If suitable provision is not made for this condition oil will leak and drip all over the machine and probably on the floor, making a dirty, disagreeable appearance.

When applying a cutting lubricant to the work and tool, it is of great importance to direct the flow to the point or points where it will do the most good. This direction is particulary necessary when several tools are in use at the same time on different parts of the work, because, as the supply of lubricant is naturally limited, the greater number of tools served, the smaller the supply to each tool.

In order to make this matter as clear as possible, several diagrams are given in Fig. 568. In the example shown at *A* the tool *B* is turning a shaft and the chip is being removed from it as shown at *E*. Now if the cutting lubricant is carried through a pipe *C* so that it flows down on the work at about the centre, the greater part of the stream is carried around in the direction of the arrow, and a great deal of it is turned away from the point of the tool by the chip itself as it curls up. If a large sized stream is used, the overflow will be sufficient for ample lubrication, but with only a small stream of compound the tool may suffer somewhat. Referring to the other view of the same piece of work, the distribution of the lubricant in relation to the tool will be clearly apparent, and a great deal of the coolant will naturally go in the direction of the arrow *D*, due to the curl of the chip.

If it were possible to throw a heavy stream of lubricant in the direction shown by the arrow *F*, the lubricating value would be considerably greater. As a matter of fact the ideal point at which the lubricants should be applied is the point of contact between the tool and the stock which is being removed. Although we are seldom able to reach the ideal, an endeavor should be made to approach it as closely as possible by carefully directing the stream where it will do the most good in cooling the tool.

In the lubrication of boring tools which are working in a deep hole, particular attention must be paid to the design of the bars, in order that the fluid may be carried to the proper points. In the majority of cases, the lubricant can be carried from the turret through a hole in the bar, and led out so that the stream will be forced against the cutting point of the tool. This arrangement is clearly illustrated in the example shown at *G*, in which the work *H* is somewhat deeply bored and there are two diameters at *K* and *L*, so that the lubricants would not flow freely over the shoulder.

The bar *M* is held in the turret by the shank *N*, and

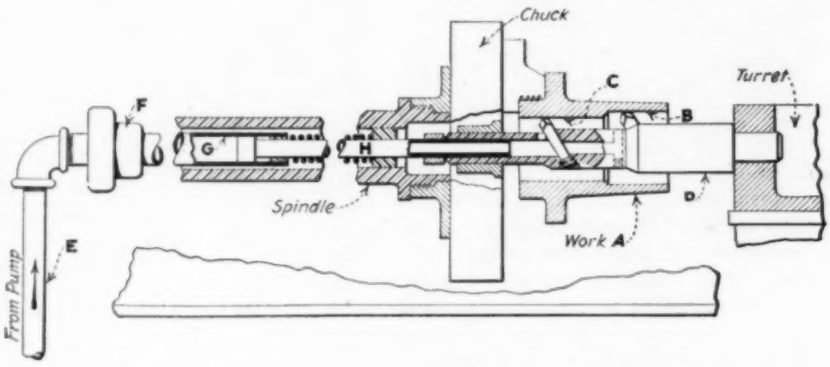


Fig. 569—Lubricating through spindle of turret lathe

a hole *O* extends all the way through the bar until it reaches the cross hole *P*, which is placed at an angle in order that the lubricant may strike the tool *Q* properly. If the hole *O* is put through the centre of the bar, and if the tool *Q* is also through the centre, it is evident

that hole *O* must be somewhat larger than the diameter of the tool. As boring tools, however, are often set slightly off-center, the hole *O* can be made a trifle larger than the tool and still allow plenty of lubricant to pass it.

When boring bars are quite long, it may be found difficult to drill a hole of this sort; and when this is the case a channel can be milled longitudinally along the bar and covered with a strip of brass, suitably fastened in place. When a gun-barrel drilling machine is available, no great difficulty is experienced in putting a hole through the bar. If there are several boring tools in the same bar and all of them must be lubricated from the same source, care must be taken to see that the channels or holes are large enough so that all of the tools will receive a sufficient supply. The combined areas of the feed holes should be slightly smaller than the area of the supply pipe.

Another method which can be used to advantage in the lubrication of boring bars in turret lathe work is shown in Fig. 569. In this case the work *A* is held in the ordinary manner in a chuck, and there are two diameters to be bored, as indicated at *B* and *C*. The boring bar *D* is held in the ordinary manner in the turret of the machine, and there is a hole part way through it from the front end. There are also ducts leading out from the central hole directly in front of each tool. The oiling device is applied at the rear end of the spindle and the pipe *E* is connected with the lubricating pump on the machine.

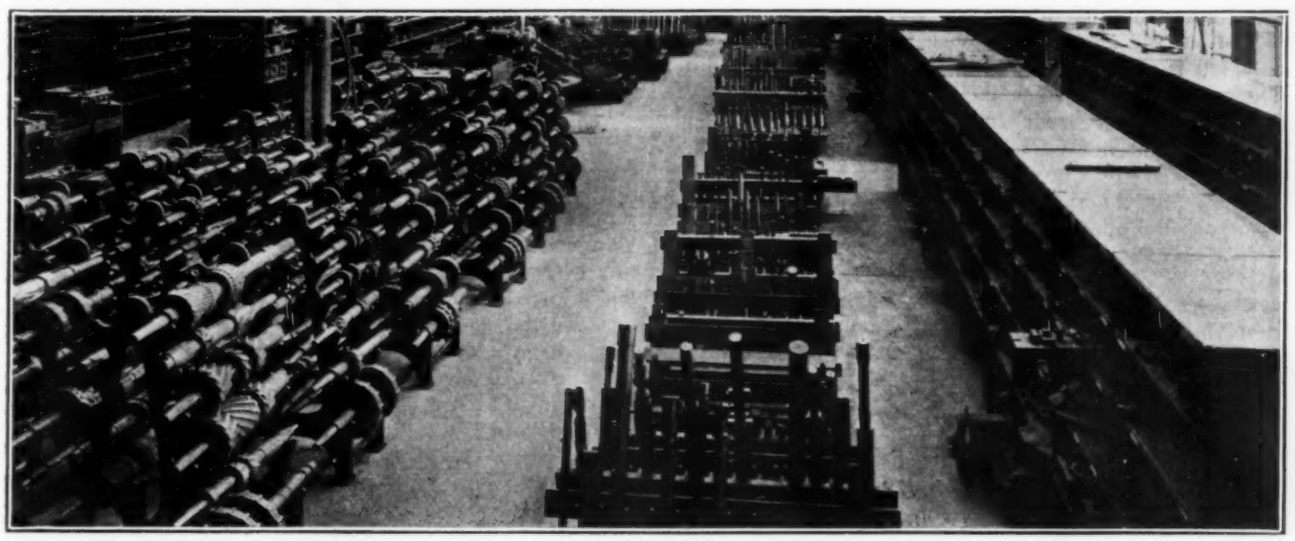
A special gland *F* surrounds the pipe *G*, which is of fairly large diameter and runs about half way through the spindle. Another pipe of smaller diameter shown at *H*, is arranged in such a manner that it will telescope into the larger pipe very readily. The forward end of the smaller pipe enters the end of the boring bar as shown and the lubricant passes through it, so that it reaches the cutting tool at the proper point. An advantage of this type of lubricating device is that it carries the stream in such a direction that it washes the chips out of the work and causes very little trouble in operation.

A suitable arrangement for shutting off the supply of lubricant is placed convenient to the hand of the operator, and a valve with a by-pass allows the unused lubricant to flow back to the pump. The application of a device like this is not costly, yet the arrangement gives excellent results. The type of turret lathe used and the general features of construction may require small variations from the design given here, yet in general it will be found that the details can be preserved much as they are for the majority of cases.

Lessons from a Modern Tool Storage Room

SPECIAL CORRESPONDENCE

The accompanying illustration, from the tool storage room of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, is of special interest in a number of ways. At the right are metal shelves for fixtures, in the center are sets of boring bars and reamers, each for some particular job, while at the left are metal racks for gangs of milling cutters.



A very modern tool storage room

There is a splendid object lesson in this picture for anyone who will study it carefully. The keeping of fixtures where they are readily accessible saves time in getting a new job started, and good shelving properly classified tends to prevent damage to the fixtures themselves.

The boring bars and reamers are also protected from damaging each other and can be readily assembled for any job which may require them. But the greatest lesson is in the gangs of milling cutters at the left. These are not only accessible while being kept out of harm's way, but they present a study in modern milling practice which is worthy of careful consideration.

Cutters are ganged and kept for the special jobs they are to perform which, while it costs a young fortune in the beginning, gives low production costs where the quantity warrants. Large, coarse-toothed cutters are used in most cases, in accord with the latest practice and it will also be noted that both right- and left-hand cutters are used so as to balance the end thrust due to the use of helical cutting edges.

These points are all important if we are to secure the greatest efficiency in lowering production costs.

Grinding in the Railroad Shops —Discussion

By Charles F. Henry

IT IS particularly interesting to note the increasing use of grinding in railroad shops, as pointed out in the very interesting article under the title given above by Howard Campbell on p. 861, Vol. 59, of the *American Machinist*. And it is not with any desire to belittle the work being done that the following criticisms and suggestions are offered. It is rather in the hope that these suggestions may lead to improved results, otherwise they would not be made. The figures referred to are in Mr. Campbell's article.

Under ordinary conditions, it would not be advisable to leave ½ in. for grinding the link shown in Fig. 1, as it is much more material than is usually needed to clean up to the desired finish. In this case, however, it may be good practice not to slot the link any closer to size, as the slotter requires the continual attendance of an operator, while the link grinder works automatically.

The crankpins shown in Fig. 3 are interesting, but seem to be turned smoother than necessary before grinding. This is a case for wide wheel grinding, which eliminates the time required for traversing the wheel. Wheels up to 9¾-in. face are being successfully used for wide-wheel or "straight-in" grinding.

The grinding of the piston rod in Fig. 4 would be improved by increasing the traverse to 15 ft. per minute and the work speed to 80 r.p.m. This means an increase of about five times in both traverse and work speed.

In grinding the shoes shown in Fig. 8, it would seem as thought the pattern had been cut down too small in order to save material to be ground off. When the castings are as close as this, it usually requires too much time for setting them up, and the scale may not be removed at all points.

The cutting speed of the wheel should be from 4,000 to 4,800 ft. per minute with a cup wheel of this kind. The traverse of the table should be increased from 16 ft. per minute to at least 40, and even 50 or 60 ft. per minute would not be too high. The depth of cut is, however, too great in any case. If the cut is reduced by one-half and the traverse multiplied by 3, much better results will be obtained.

Too Much Wheel Surface on Work

The fixture for holding the work should be raised, so that the work crosses the cup wheel at, or near, the center. With the work at the bottom of the wheel as shown, there is altogether too much wheel surface in contact with the work. The chips which are formed are much too long and fill up, or load, the wheel. The position of the work with relation to the wheel is much better in Fig. 7, where guides are being ground. Both of these applications of the Diamond grinder represent good practice, but it is felt that the suggestions made will show improved results.

The use of string fixtures is, of course, necessary in a machine of the type shown for grinding both shoes and guides. The rapid traverse of a grinding machine makes it necessary to load and unload the complete fixture at once, which means that the machine is standing idle during this time. This is why some operations can be handled more economically on a milling machine holding only two pieces. Fixtures for these machines can frequently be arranged, so that one may be loaded while the other is in the cut. The rapid traverse on modern milling machines practically eliminates lost time.

In grinding the small gas engine cylinder shown in Fig. 10, the wheel speed is about 400 r.p.m. too high to secure best results. It is suggested that the wheel speed be reduced to about 6,500 r.p.m., and that the depth of cut be reduced, but that the feed per revolution be increased.

Both Figs. 11 and 12 show what is apparently considerably more overhang of the grinding spindle than necessary. In the case of Fig. 12, the work speed seems too high, while the speed of the wheel is too low to secure the best results.

The method of grinding the spiral cutter as shown in Fig. 13, has much to commend it. The support for the tooth rest is very ingenious. A rounded top on the tooth support will avoid touching the edge. It is also noted that the wheel is running in the proper direction with relation to the cutting edge to avoid forming burrs, even though they be very small.

The dog on the shank indicates that the cutting edge is kept in contact with the tooth support by the hand of the operator on this dog. It is believed that the method of clamping a small rope or round belt on the end of the milling cutter, wrapping it around the shank a few times and leading it up over a pulley with a counterweight, will be of material assistance in grinding cutters of this kind. Such a device will automatically keep the edge of the tooth against the tooth support as the carriage moves along its bed.

Casting Crown Brasses and Hub Plates in Place—Discussion

By J. E. Eson

In our shop, which is maintained as a running repair shop (although it also gives general repairs to the smaller classes of engines), it all depends on the rush of work as to the way we handle the job. If we are rushed for machines and time, we finish the hub plates on a 24 or 30 in. lathe which takes 45 min. to 1 hr., according to the size and how much stock comes off. Our hub plates come to us 1¼ in. thick and are fastened to the wheel instead of the driving box.

The crown brasses are cast in halves and put on a flanged mandrel and turned to outside diameter. It takes from 45 min. to 1 hr., to set up and turn each one on a lathe. Then the edges are slotted and the brass pressed in the driving box at 50 tons pressure. It takes 30 to 40 min. for this operation, after which the driving box is set up on the boring mill and bored, the time being 50 min. to 1 hr. We can do hub plates on the boring mill in 30 minutes.

If, at the time driving-box crown brasses are renewed and new hub plates put on, the engine can be spared long enough we make No. 2 repairs. Then the side rod brasses are renewed, the main rod brasses reduced and rebored, middle connection pins refitted or renewed, crosshead pins refitted and trued up on the journal, valve motion reset and refitted, valve and piston packing renewed, shoes and wedges taken up and piston rods examined. This work requires from 4 to 6 days.

The mileage on driving boxes and hub plates depends on the road bed and how the shoes and wedges are kept up. If the road bed is straight with few sharp curves, we can get 90,000 to 100,000 miles out of the crown brasses and hub plates.

The Genesis of the Pelton Wheel

By A. T. Parsons

How the forty-niner and his need for mining equipment developed the machine business in San Francisco—Modern methods of building large hydraulic turbines

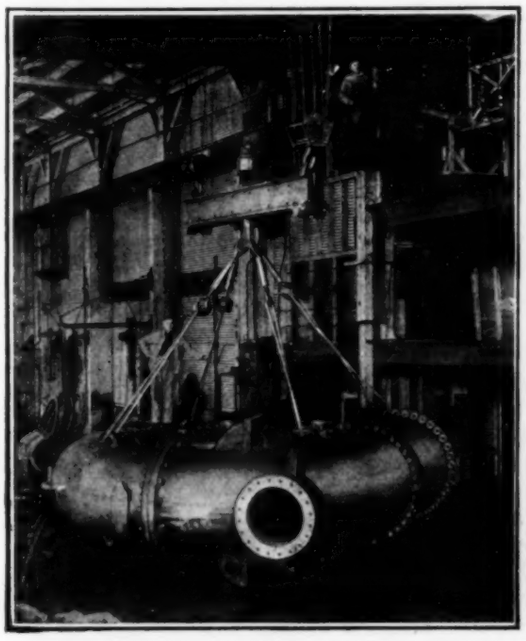
BRET HARTE and Mark Twain have both immortalized the "forty-niner," but who will sing of the man who made and repaired the forty-niner's tools? At first, to be sure, the Argonauts worked the river bars by hand with the simplest kind of equipment, but this condition was short-lived. Quartz mining commenced in 1851, and hydraulic mining about the same time, both calling for heavy and complicated machinery. Until the completion of the first transcontinental railroad in 1869, freight charges on machinery and metal equipment from eastern factories were prohibitively high and deliveries exasperatingly slow. Thus isolated, the western shops of that day were forced to build nearly all the equipment used in every industry, while as far as the mines were concerned, the California manufacturer had not only to build, but also to design most of what he built. In fact he was as truly a pioneer as any of the Argonauts.

The result of all this was the development in California and western Nevada, during the sixties and seventies, of a remarkable group of shops engaged wholly or mainly in building and repairing mining machinery. The shops along the Comstock Lode at Carson City and Virginia City, and on the Mother Lode of California at Grass Valley, Nevada City, Placerville, Angels Camp, and Sutter Creek, were, on account of poor transportation, called upon to handle all kinds of breakdown jobs originating in their immediate neighborhood, but many of them built a good deal of new machinery as well. The San Francisco plants were mainly concerned with the building of new equipment. Many types of mining equipment that have become standard the world over, had their origin in those days.

At first the lack of a local source of pig iron proved a considerable handicap, but conditions soon arose that minimized this difficulty by lowering the cost of imported iron, since in the early sixties, grain from the valleys of California began to be exported to Europe in "windjammers" around Cape Horn. The shortage of ordinary return cargo caused the freight rates on European pig to be very low.

In the late seventies, one of the most important among the Mother Lode shops was the one owned and operated by a Scotchman named G. G. Allen, at Nevada City. A good workman himself, Allen seems to have had the faculty of grouping around him a number of versatile mechanics of the old school, each an expert in his line, both willing and able to tackle any kind of a job that came along.

Early in the spring of 1878 or 1879, Lester A. Pelton came to Allen's shop with an idea, plus a set of patterns for the buckets of a waterwheel. Pelton was born in Ohio, had crossed the plains in 1850 to seek his fortune, and, like most of the other Argonauts, had failed to find it. During the intervening years he had been by turns miner, carpenter, and millwright,



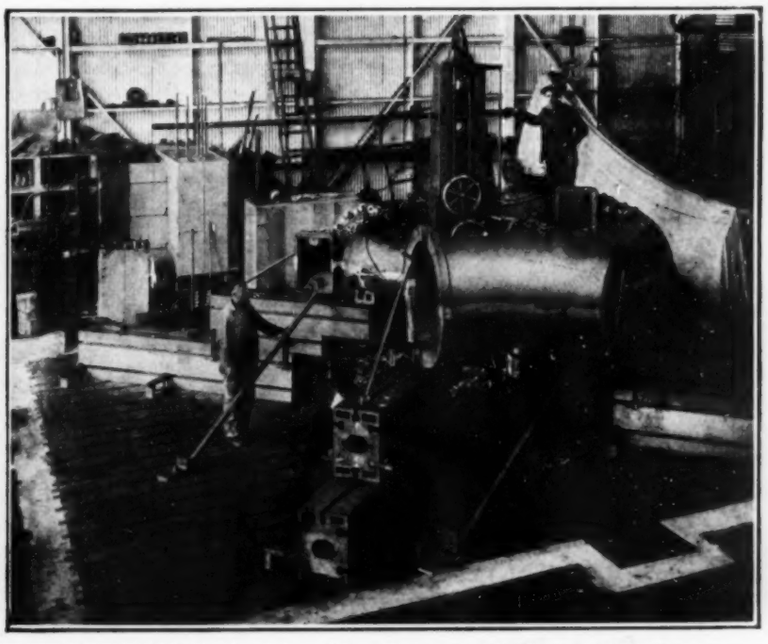
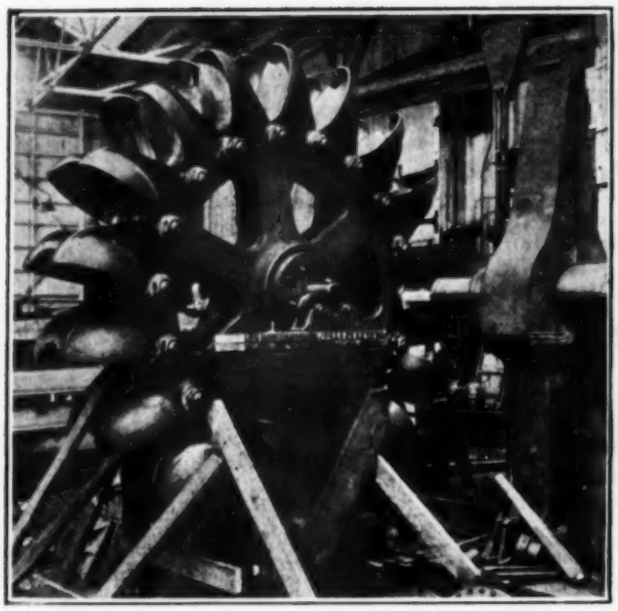


Fig. 1—Handling 27 tons on two cranes. Fig. 2—Method of handling large work for machining



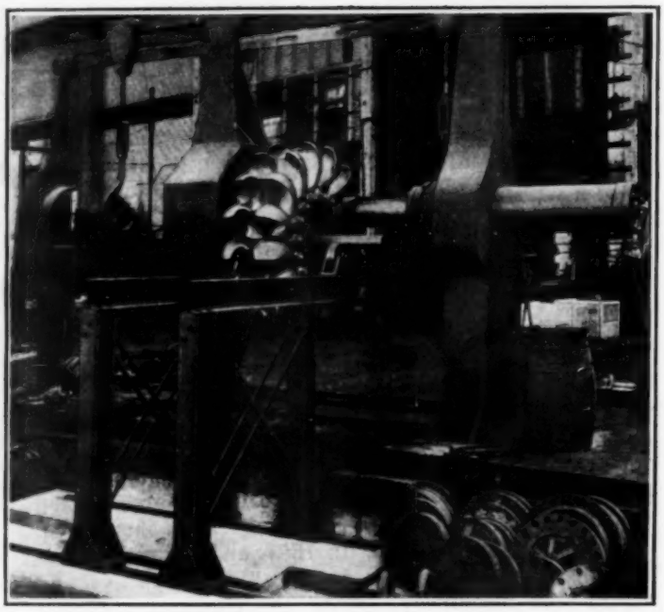


Fig. 3—Pressing bolts in buckets and centers. Fig. 4—Stand for handling wheels while pressing in bolts

and had acquired a full white beard, the title of "old man Pelton," and little else but experience. Add to all this, the fact that he had spent the previous winter snowed in at the nearby village of Camptonville, in trying to develop an improved waterwheel, and that he had been obliged to work at night because the water pressure was too variable during the day. Had you been standing in Allen's shop the day he appeared, you would probably have said, "crank inventor" and let it go at that. But you would have been wrong. For Pelton's toilsome winter had resulted in the discovery of an important improvement in the methods of utilizing water power. Waterwheels driven by a jet under pressure were in general use in the mining districts at that time. They were usually crudely constructed and of low efficiency, so that designing an improved waterwheel had come to be a favorite indoor sport. In fact, at least two other men appear to have conceived the idea of a bucket with the central wedge dividing the jet. But, it was Pelton who, working independently of the others, made the first practical application of this principle, and thus scored a material increase of efficiency over the wheels then in use.

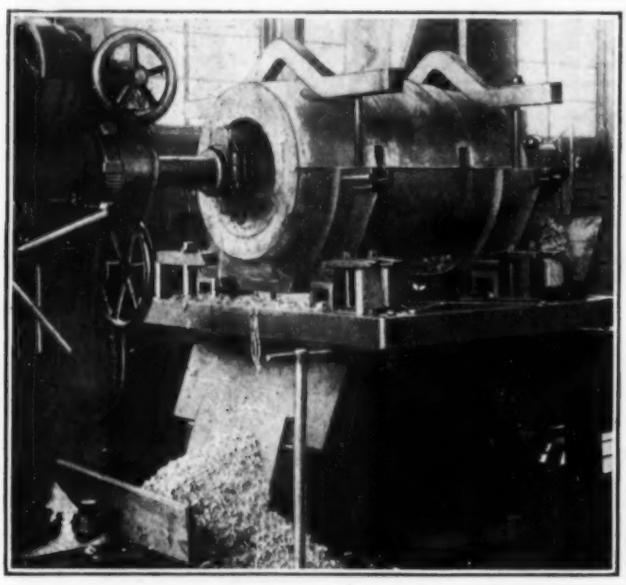


Fig. 5—Boring a large bearing

Allen became interested in Pelton's invention, and financed a considerable amount of experimental work, which was carried on in his shop. In 1880, Pelton's first patent was granted, and for several years, Pelton wheels were built at Allen's shop, Pelton sharing in profits from sales, and helping out his income by working for Allen as a carpenter and millwright. Friction, however, developed between the two quasi-partners over questions of policy. Allen, who naturally regarded the Pelton wheel merely as a side line, was content to see sales grow surely but slowly. When Pelton claimed, what was probably true, that a San Francisco agency and possibly a San Francisco factory was necessary if the business was to grow as it should, Allen was not inclined to risk any more of his modest capital. Such a divergence in viewpoint was probably inevitable.

Finally, in 1887, Pelton packed up his models and went to San Francisco, where he met E. L. Brayton, Sr., of the firm of Rankin, Brayton & Co., proprietors of the Pacific Iron Works, and pioneer builders of mining, and milling machinery.

Cut-Throat Competition

One of Brayton's contemporaries, a man particularly able to give an unprejudiced view of conditions, states that the manufacturer of most mining machinery was at that time suffering from a period of cut-throat competition. The more important types of equipment, such as stamp-mills and quicksilver-roasting furnaces had become standardized, and any particular contract was likely to be awarded either on a strict price basis, or as a result of entertainment extended to the purchaser by the salesman, such entertainment being mainly of types that have now become illegal.

Brayton was too conscientious a builder to indulge in indiscriminate competition, nor had he any taste for the second method of competition. He had, at

various times, built a number of waterwheels from different designs, and he readily saw the superiority of Pelton's invention. It appears to have appealed to him as giving an opportunity to develop a line where engineering experience and skill could be sold, and not merely so many machined castings, properly assembled.

Business Changes Hands

Be that as it may, Brayton acquired Pelton's interests and organized the Pelton Water Wheel Company to carry on the business, which grew so rapidly that he was soon obliged to devote his entire time to it, retiring from the Pacific Iron Works, which was later liquidated. Before long the manufacture of reaction turbines was commenced as well, the Pelton wheel itself being properly an impulse turbine.

All this occurred at the beginning of the hydroelectric age. Had the necessity continued, as had been the case for thousands of years, to use water power within a few hundred feet of where it was generated, the Pelton Water Wheel Co. would probably have kept on building a number of wheels of 100 hp. or less each year, and would have sold them mainly to miners and others living in mountainous districts. But the hydroelectric age came, requiring generating units up to 20,000 hp. and more, each job calling in the main for special construction throughout. Moreover, the exacting requirements of the hydroelectric industry compel not only a refinement of design in the main unit undreamed of forty years ago, but also call for much accessory apparatus, such as governors, pressure regulators, and so forth.

The Present Pelton Shop

The growth of the Pelton Water Wheel Works can best be seen by noting the views taken in its present shop in San Francisco. An idea of the size of the work can be had in Fig. 1, where a turbine casting is shown slung from two cranes by means of an equalizing beam. The total weight of the casting is 55,200 lb., while Julius Herzler, the shop superintendent, adds another 200 lb. to the load. Fig. 2 shows how large work of this kind is supported for machining. The large, hollow, rectangular blocks, have T-slots planed at convenient intervals, which make it easy to tie the pieces together as well as to fasten them to the large floor plate.

The next two illustrations, Figs. 3 and 4, show how the bolts which hold the buckets in position are pressed into place. These bolts must be a good fit and are forced in with pressures ranging from 15 to 50 tons, depending on their size and length. Fig. 3 shows a large wheel supported on a sort of makeshift trestle. Shown in Fig. 4 is a later method of supporting the wheels, this device being capable of handling quite a variety of sizes. The wheels are supported on rollers for easy handling.

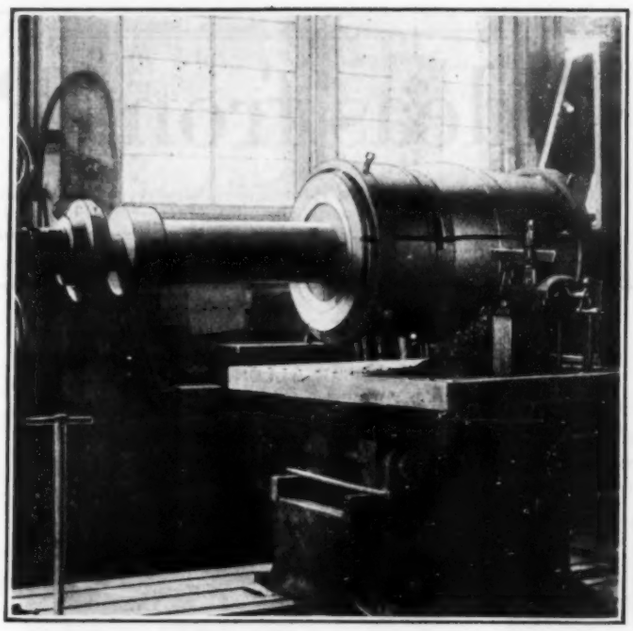


Fig. 6—Turning the outside of a spherical bearing

A method of boring and turning large bearings having spherical seats is shown in Figs. 5 and 6. The work is being done on a large horizontal boring machine equipped with a rotating table.

After boring the bearing with the cutter head shown in Fig. 5, the two halves are clamped to a large mandrel by rings on the ends, as shown in Fig. 6. A tool block is mounted on the table which is then rotated by means of the gearing shown, so as to turn the spherical seat on the outside. These bearings are approximately 20x64 in., and the size gives a good idea of the character of work handled and the problems involved. Another large shaft and its bearings are shown in Fig. 7, in which six oiling rings are provided for each bearing.

Lubrication by means of rings dipping in oil and carrying up the lubricant as they revolve with the shaft, has been found eminently satisfactory.

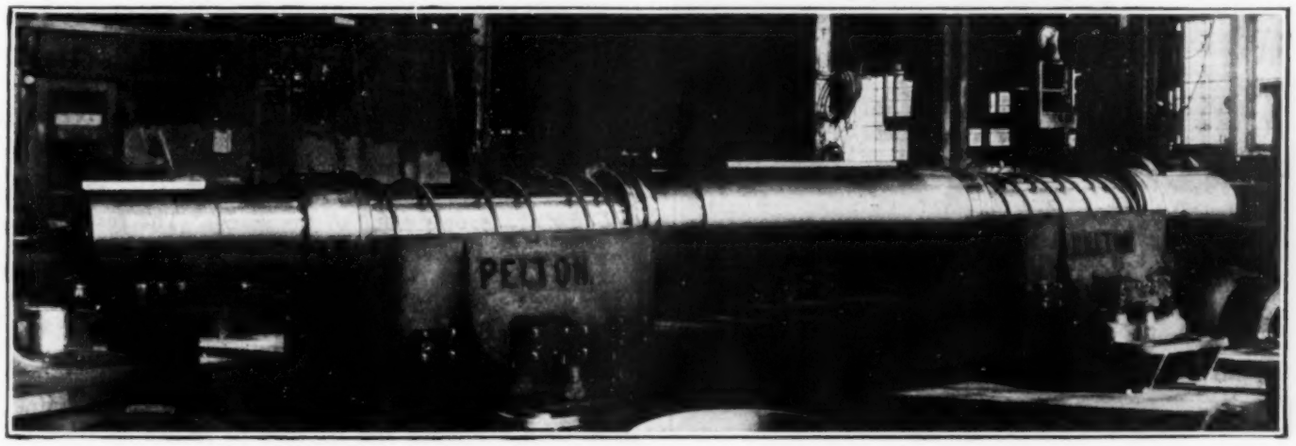


Fig. 7—A large turbine shaft

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for.

An Air Operated Lathe

By Edgar Allen

Not long ago a broken down engine in the power plant of a small railroad shop put the machine shop out of commission. The air compressor outfit, however, was undamaged, so the foreman had a big air drill coupled

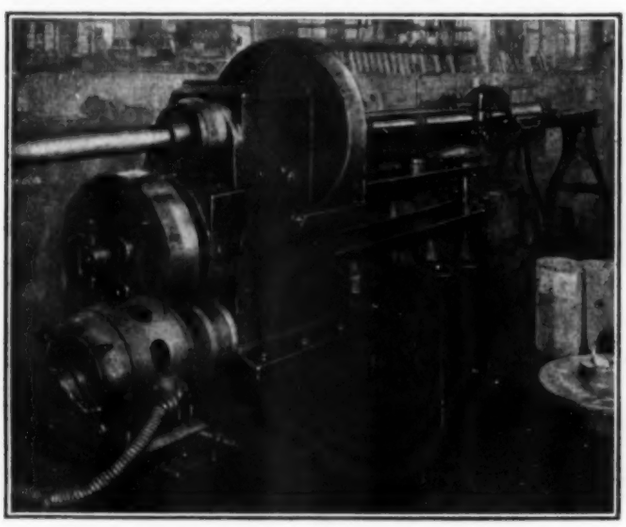
Air drill coupled to lathe

to one of the lathes as shown. This made it possible to turn up some badly needed repair parts for the engine and to get it going again in a short time.

Friction Drive for Machines

By Charles A. Trask

The accompanying illustration shows a simple form of friction drive that was applied to a battery of six broaching machines recently moved into a new building of the Rockwood Manufacturing Co., Indianapolis, Indiana.



Machine driven by friction pulley on motor

In the old building the machines were belt driven in the usual manner, but as the roof of the new shop over the location chosen for these machines was about 30 ft. above the floor, it was necessary to use some type of drive other than belt.

Tarred-fiber frictions were applied to the motors, as shown, the motors being set on sliding bases on the shop floor. This method of driving has proved so satisfactory that the company is contemplating applying it to punch presses and other constant-speed machines.

As a result of the change in driving, two 10-ft. countershafts, 6 hangers, 10 pulleys, 94 ft. of 6-in., 105 ft. of 5-in. and 154 ft. of 4-in. double belting were put out of commission, and either sent to the stockroom or used for other purposes.

Vibration Dampener for the Screw Machine

By Donald A. Hampson

The screw shown in Fig. 1 was being made on a model C Cleveland automatic screw machine having three holes in the turret. The turret set-up included a stop in one hole, a box mill in the front slide and a die in the last hole. With the cut-off tool on the front slide and a forming tool on the rear one, not to mention a knurling attachment, there was very little working clearance left, though the tool arrangement was all that could be desired and the work proceeded efficiently.

The screws were made in various lengths, the longest being that shown in Fig. 1—all the difference in length being made up on the threaded part. The only slow part of the job was the long turning operation, and, though this could have been done more quickly on another type of machine, it was considered good policy to let well enough alone, inasmuch as the operator had other work on which he could put in his time. The only expensive part of the work occurred in connection with the longest length of screw. Forming the neck and teat was done with a single circular tool, as the last operation before cutting off. As the bar was cut down toward the ¼-in. diameter teat, it was found too frail to eliminate vibration, due both to the cut and to the long overhanging end of the screw. The result was that the screw would break from the bar and be spoiled. This occurred only with the screw of the length shown.

To avoid this spoilage, the expedient was adopted of holding a stick against the end of the screw while the forming tool cut the last sixteenth. This steadier saved the screws but it occupied the best part of the operator's time, for he couldn't be away from the machine more than a minute and be sure to return in time to place his stick at the critical moment. In due time, the

vibration dampener illustrated in Fig. 2 was made and proved to be highly successful. The casting *A* is a block fastened to the rear slide and holding the forming tool *B*. Another casting was added, occupying the space above the extended floor of *A*. The bolt *C* was made to pass through both of these castings, the nut on top making it more convenient than before to shift if so desired. The drawing is a side elevation and as such does not show the added casting but it does show the plate *D* which covers the full size of the casting. The plate confines the slide *E*, which is a piece of ½x2-in.

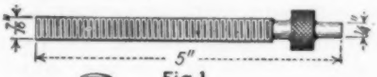


Fig.1

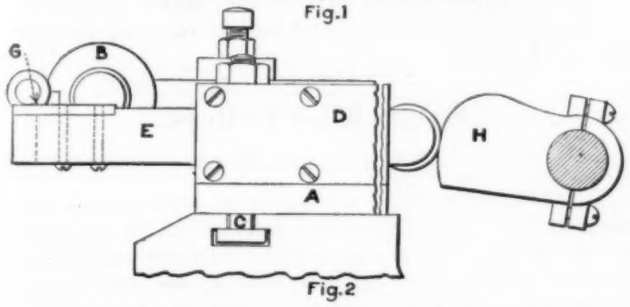


Fig.2

Fig. 1—Long, slender screw to be made. Fig. 2—The automatic vibration dampener

cold-drawn steel, made a sliding fit in the casting. No particular strength or heavy duty was required of the dampener; merely a piece that would bear lightly against the screw near its end and prevent any whip. This was accomplished by the movement of the slide *E* at the proper time. The slide carries a shoe, or wearing piece *G*, at its upper front end. At first this shoe was made of brass but the screw soon wore a hollow in it. Later a piece of hardened tool steel was attached and found to work without damage to the threads. The upper face of the shoe was made ¼ in. higher than the normal lower curve of the screw and gave pressure enough without any pinching at the forming tool.

Very little time and space being available, a cam with quick rise and return and a short dwell had to be used. As may be noted this cam, which is shown at *H*, was added to the cam shaft of the machine. Its longitudinal position was close to the cross-slide drum. By giving the cam a rise of 3½ in. it was possible to bring the dampener up and allow it to work, returning fast enough to clear the various tool movements.

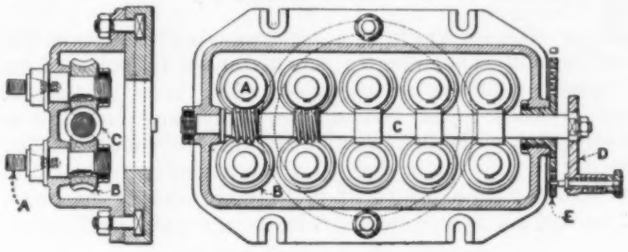
The outlay for this attachment was small. It is too simple to get out of order. Its use has saved the most of one man's time, and it may have a wider application when its value in preventing that breaking off which so often accompanies slender necks is realized.

Indexing Fixture for Multiple Milling

By Fred Clayton

The fixture illustrated was designed for milling hexagonal or other symmetrical faces and for castellating nuts.

The base is made with a turntable so that the fixture can be set either in line with, or at a right angle to, the table of the milling machine. The ten work-carrying spindles *A* have the worm wheels *B* attached at the lower ends. The shaft *C* has five worms cut thereon and is provided with the indexing crank *D*. Since the worms and wheels are always in mesh, rotation of the shaft *C* causes simultaneous movement of all the ten spindles. An index plate *E*, in connection with the index



Indexing milling fixtures

crank and pin, makes provision for indexing the work as may be required.

In straddle milling, two pairs of straddle mills will machine work on both rows of spindles when the fixture is mounted in line with the table. With the fixture set at a right angle with the table, work on all ten spindles can be milled by six cutters, providing all but the two outside cutters are made of the proper width to mill the adjacent faces of work on separate spindles.

How to Remove Bushings

By A. L. Fisher

The accompanying illustrations show two methods of removing bushings which are so located that purchase against the inside face is possible. The device is Fig. 1 is for use with bushings having thin walls. To be durable, the tool should be forged.

When the bushing has a small bore and thick walls

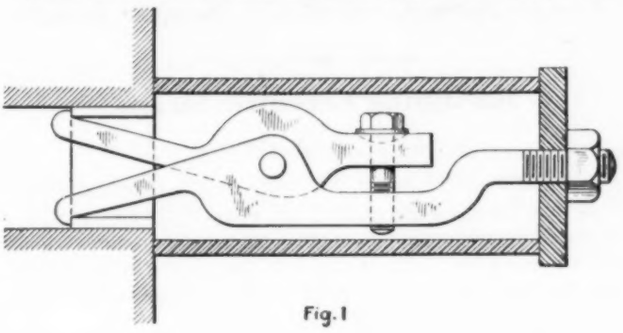


Fig.1

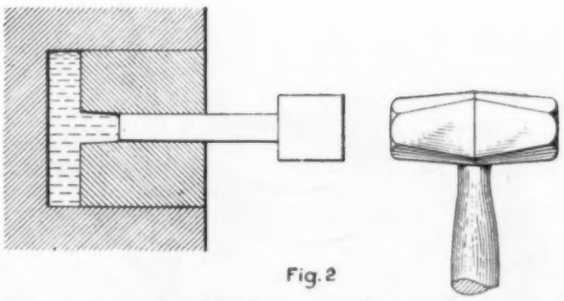


Fig.2

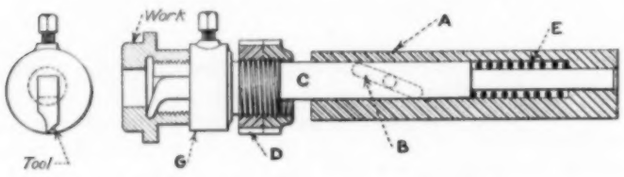
Fig. 1—Removing bushing with thin wall. Fig. 2 Removing bushing with thick wall

the method shown in Fig. 2 is applicable. Oil or grease is inserted to fill the space back of the bushing and a close-fitting pin is inserted in the bore. The pin is then struck a sharp blow by a heavy hammer or sledge.

Internal Recessing Tool for the Screw Machine

By James Clearman

The tool shown in the accompanying sketch is for cutting internal recesses or clearances in holes to be tapped or otherwise threaded. The body *A* has an eccentrically bored hole of two diameters and is provided with a slot *B* milled at an angle to the axis. The shank of the toolholder *C* is eccentrically turned and provided with a pin to fit the angular slot in the body. The tool bit is held in a slot in the enlarged part of the



Recessing tool for screw machine

holder and clamped by the screw shown. Two nuts *D*, can be adjusted to limit the inward motion of the holder within the body which motion is opposed by the spring *E*.

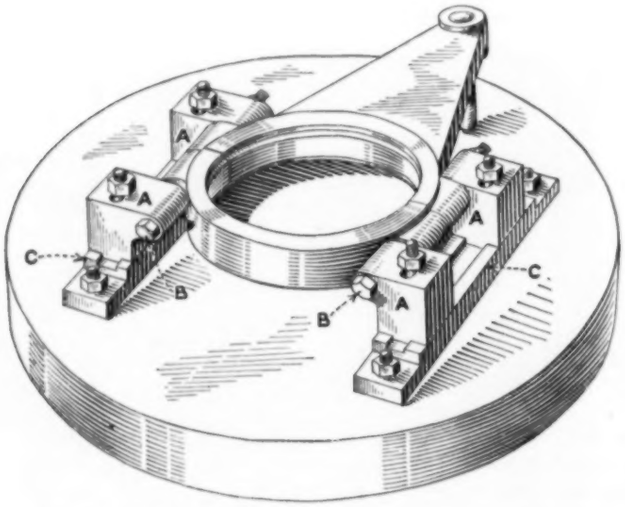
In operation, the face *G* of the tool is brought against the work, compressing the spring *E* and causing the holder to turn by reason of the longitudinal movement of the pin in the slot *B*. Since the shank of the holder is eccentric, turning it causes the tool to be fed into the work, cutting an annular groove therein.

The depth of the groove is limited by the amount of longitudinal movement of the body after the holder makes contact with the work. The rate of feed of the tool in the groove is controlled by the speed of turret travel.

Machining Eccentric Straps

By M. J. Dempsey

Eccentric straps are liable to go out of round while being machined, especially if they are of light section. The best way to make eccentric straps is to have them cast in one piece. First the bolt lugs should be drilled and reamed; then the straps should be sawed in two through the bolt lugs. In no case should the sawed surfaces of the lugs be remachined.



Fixture for boring and facing eccentric straps

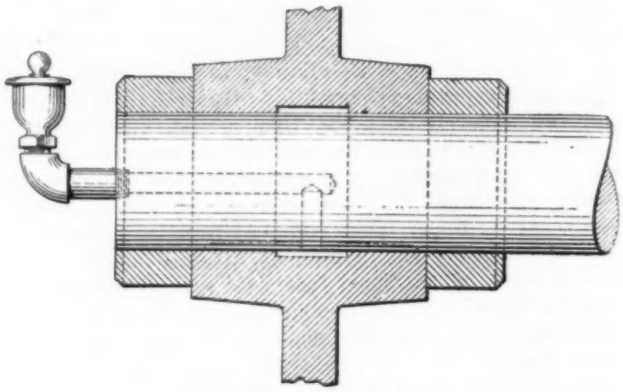
The straps can now be put in the fixture shown herewith, and bored and faced. The bolt lugs of the strap are laid between the floating clamps *A*, where the halves are held in proper relation to each other, and clamped by the through bolts *B*. The clamps are tongued into the slides *C*, in which they can float until fastened to the face plate of the lathe or the table of the boring mill, depending on which machine is used for the work.

The construction of the fixture is such that the straps can be bored and faced on both sides at the one setting. A heavy, fast cut can be taken without danger of distorting the straps in any way, which means that they will fit the eccentrics and require no scraping after being machined.

Oiling Idler Pulleys

By William J. Fisher

In our shop we have a number of idler pulleys running at high speeds upon the ends of shafts, as shown in the sketch. Instead of drilling oil holes and cutting grooves in the hubs of the pulleys, we drill a hole endwise into the shaft and tap it for a ¼- or ⅜-in. pipe; then to a nipple and ell we secure an oil cup from which the oil will flow through the hole in the shaft to the center of the pulley hub.



Oiler for idler pulley

A radial hole is drilled in the shaft to meet the hole in the center and a groove cut in the surface, always making sure to have this hole and groove on the underside of the shaft. The middle of the pulley hub is chambered out to form an oil reservoir that will maintain the supply for a time when the cup is empty.

Spindle Arm for Sweeping Molds

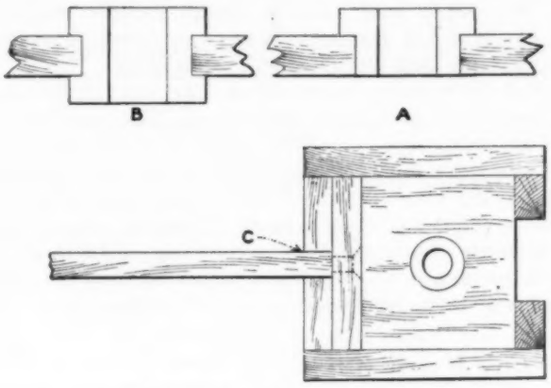
By James McLachlan
Birkenhead, England

When loam molds are to be swept, it is the usual custom for the molder to bolt the sweep to an iron arm which may move freely up and down the spindle or be confined by collars above and below the arm boss. The sweep is accurately set by means of a spirit level and a gage stick furnished by the patternmaker.

The accompanying sketch shows a box arm which the writer saw many years ago in a propeller shop and has since used to advantage in many other places. Its special advantage is that the patternmaker makes the

sweep to correct measurement and the molder is not required to make any adjustments.

The box may be 12 or 15 in. long, made of 1½-in. material, and have brass bushings fitted into the top and bottom plates as shown at *A* and *B*. The plates may be divided in order to insert bushings having



Box type of arm for sweep

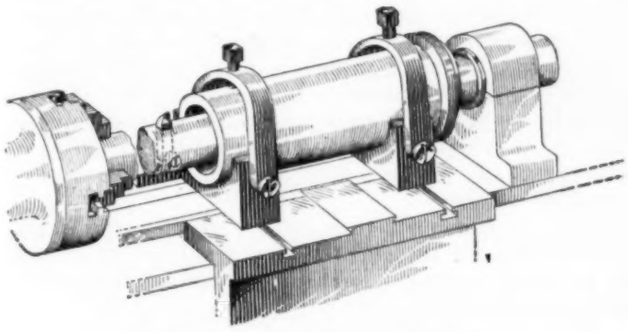
flanges above and below the plate, as shown at *B*. The sweep fits into the slot at *C* and is held by screws from the back. When the box is dropped over the spindle, collars may be used if desirable to prevent it from moving up or down.

Boring Bushings in a Lathe

By James M. Call

The accompanying sketch shows how we rigged up a short-bed lathe that was otherwise unsuitable for the job to bore and face the ends of some long liner castings, or bushings at one setting. The boring bar was gripped in a chuck at the headstock end, while the rear end was supported in a bearing bolted to the wings of the carriage, and bored in position to secure positive alignment.

For a cradle in which to hold the castings to be bored, a block of iron was first bored out to correspond with



A boring job in a short lathe

the outer diameter of the castings and then sawn in halves. The two parts were then secured to the wings of the carriage by means of suitable straps and clamping bolts. The original bore was purposely made a trifle smaller than the required size and a finishing cut was taken over the cradles with a fly-cutter in the boring bar.

Swinging clamps, attached to the ends of the cradles and having setscrews at the middle of the yokes, made a very convenient means of holding the work, and the liners could thus be handled quite rapidly and with complete assurance that the bore would be parallel with the outer surface.

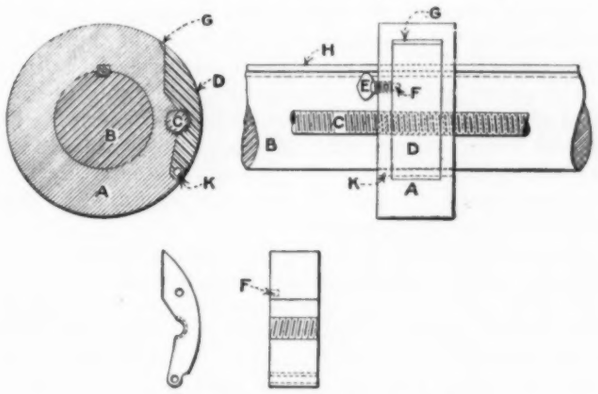
Holes were put in the bar so that tool bits could be inserted in the proper positions for facing both ends of the bushings without moving them.

Rapid Return Head for a Boring Bar

By E. S. Brown

In the boring bar shown in the accompanying illustration, *A* is the tool head; *B*, the boring bar; *C*, the feed screw; *D*, the feed-screw nut; *E*, the thumb screw that holds the nut in contact with the feed screw; *F*, a hole for receiving the reduced end of the thumb screw; *G*, a recess in which a flat tool may be inserted to loosen the nut should it become tight; *H*, the key; and *K*, a pin to which the nut is pivoted.

In operation, when the head has traveled to the end of the cut, the thumb screw *E* may be loosened, allowing



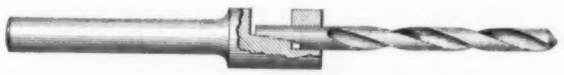
Details of rapid return head

the nut to swing out from its seat and thus be disengaged from the feed screw. The head may then be pushed, or pulled back to the starting point. It will be noticed that threads are cut on slightly less than half a circle of the nut.

An Extension Shank for a Drill

By L. H. Garey

The illustration shows a simple exension shank for a drill, where the extension is not intended for allowing a hole to be drilled deeper than the length of the drill, but



Extension shank for a drill

merely to allow the drill to reach places where the drill chuck would interfere with some part of the work.

The end of the drill shank is flatted on a slight incline as shown, the seat in the extension being filed to the same incline. A tap on the end of the drill with a soft hammer will make it tight enough in the extension to do its work. Drills of varying sizes can be used in the same extension, by turning the shanks to fit and filing flats at the ends.

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Editors

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Interest in Railway Shop Work

ONE OF the interesting experiences in visiting the shops of the more progressive railroads is to note the wide awake way in which many of the shop executives are meeting the new problems which are being presented. The use of alloy steel in locomotive construction, which is growing on many roads, affects the machining of these parts while the gradual elimination of the link motion is making the machining of eccentrics, and eccentric straps and the fitting of the rods or blades less and less of a feature than formerly.

The grinding machine is finding its way into the railroad shop to a greater degree than ever before. The use of valve motion with pin joints now makes the cylinder grinder more and more of a necessity. Both pins and bushings are easily renewed by finishing them with the grinding machine.

The milling machine too is beginning to be used more in some railway shops, not only on side and connecting rod work, but for shoes, wedges and even crossheads. One recent example seen was the finish milling of the guide bearing surface of babbitt in the crosshead. This work was being done by a large inserted tooth cutter at one pass in less than thirty minutes per crosshead, including both bearing surfaces. Standard machines are preferred when they can be obtained because of their wider range of usefulness. Money for new machines is always hard to find and the shopman wants to make it go as far as possible.

But the keen interest which the up-to-date railway shop executive takes in everything that will help him in keeping locomotives on the road at the lowest cost, is most gratifying from every angle.

Foretelling the Future From the Past

IT IS becoming quite a common practice to compare present conditions with those of some previous time and then to assume that the events which followed at the earlier date will be duplicated in the immediate future. Reasoning from past experiences is better, of course, than blind guesswork but it is a dangerous pastime when no allowance is made for the unexpected.

The practice of establishing lines of economic trends is open to the criticism we have just made. Generally speaking such trend lines are made straight while actual developments may follow various geometric curves of increasing or decreasing curvature. We are not referring to fluctuations which appear as waves or peaks but to the long time movement.

In a rapidly advancing industrial civilization such as exists in the United States, trend lines are seldom straight. The sales curve for a short time after the introduction of a new device may be rather flat until the idea takes hold, then it jumps rapidly, flattening out again as the market reaches saturation or decreasing as some new development replaces it.

Even with basic commodities like steel it is unsafe to predict on a straight line basis. New uses are constantly being discovered for them and the rise of the curve is more apt to accelerate than remain constant.

In laying plans for the future, therefore, it is hardly wise to figure only on a basis of steady, slow growth. It is quite as likely that something unforeseen will occur to create an entirely unexpected demand and it is as well to be somewhat prepared to meet it.

Another Metric Bill Is Introduced

ETERNAL vigilance is the price of safety from the efforts of ill-advised enthusiasts. Notwithstanding the emphatic disapproval of compulsory metric legislation by American manufacturers, business men and engineers, a new metric bill has been introduced in the House of Representatives. The bill is known as H.R. 10 and is sponsored by Mr. Britten.

At present the latest attempt of the metric organization is reposing in the Committee on Coinage, Weights and Measures, but it may come to life almost any time and will bear watching.

A Step Toward State Socialism

IN THE early days of the present session of Congress a bill was introduced in the House directing that the construction and maintenance of material used by the naval and military forces be carried on in government shops provided they are equipped for it and can underbid private concerns.

One of the interesting features of the bill is the provision that government shops bidding on such work are not permitted to charge for general overhead incurred because of maintaining the plant for emergencies. There is so much latitude in this provision that the government plant should have no trouble in underbidding the private plant. Should this surmise be correct the bill practically provides that all such work be done in government shops.

Another statement that strikes us as being rather ingenuous is to the effect that the purpose of the bill is to relieve unemployment among civilian workers of the government.

If we were asked we could sit right down and name a hundred or so manufacturers who would fall over themselves to bid on the same terms as the government plant managers provided some kind friend would take care of overhead in the same way. And they would probably welcome some proposal looking to the maintenance of their trained staffs in dull times.

The number of the bill is H.R. 2702 and it was introduced by Mr. Hull of Iowa.

Shop Equipment News

Hendey No. 2G Geared-Head Milling Machine

The Hendey Machine Co., Torrington, Conn., has recently brought out a milling machine with an all-geared, constant-speed drive, to be known as the No. 2G. It incorporates several new features for which distinct advantages are claimed.

The machine can be belted direct to the main line shafting if desired, as the drive pulley runs in substantial double-row ball bearings, is fitted with a clutch for starting and stopping, and the direction of rotation of the spindle is reversible at the will of the operator by means of mechanism within the column of the machine. A belt guide, adjustable for direction and spread, extends to a distance of 6 ft. above the floor level.

There is a clutch lever on each side of the machine, so that it may be stopped and started by the operator from either position. The spindle reverse lever is on the right side of the machine, and reversing the direction of rotation of the spindle does not reverse the direction of feed.

The spindle is of the same type of construction as the spindle of the Hendey lathe. It runs upon taper journals in bearings of Lumen bronze and is adjustable to compensate for wear by means of collars upon the rear end. The bearings are lubricated by means of ring oilers, dipping into reservoirs below them, a gage being provided to indicate the level of oil in these reservoirs at all times.

The spindle has a through hole 1 in. in diameter, and the front end has a No. 11 Brown & Sharpe taper hole for cutter shanks. The spindle nose is of the key flange type and insures a positive drive for large cutters. The drive is through the main spindle gear, regardless of the rate of rotation, and this gear is keyed firmly to the spindle.

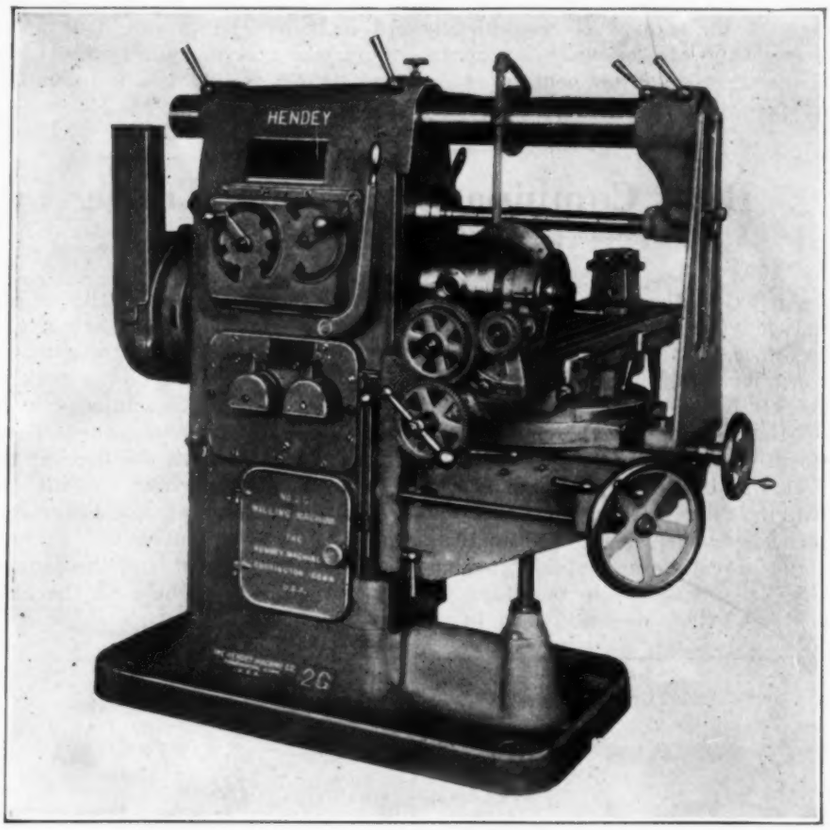
There are 18 spindle speeds, ranging from 15 to 355 r.p.m., and controlled by two levers. A direct-reading index plate mounted over the levers enables the operator to make the setting with certainty. All gears except the main spindle gear are of alloy steel and heat-treated.

By withdrawing the holding screws from the cover of the drive gear train, all members of the train are easily accessible for inspection, and it is not necessary to disconnect the controlling levers to accomplish this removal. The feed gear train is constructed as a unit and may be lifted out of the machine entire, by simply removing the holding screws from the cover.

Lubricant is supplied to all bearings and gears in the drive and feed trains from a trough located directly under the overarm. A separate tube runs from the bottom of the trough to each bearing and each pair of gears in mesh, so that a constant stream of oil is directed upon every wearing surface. The level of the oil in the trough is maintained by a centrifugal pump, located in a reservoir at the rear of the machine inside the column, and to this reservoir all of the oil returns through felt strainers.

The over arm is ⅝-in. larger than it was formerly made and is supported in substantial bearings at the top of the column. The front bearing is a steel split sleeve which is keyed to the arm and provided with a stop, so that the outboard support swings only to the operator's right and when returned to position it is positively stopped with the center in proper alignment with the spindle.

The feed gear train provides 16 changes of feed, ranging from 0.04



Hendey 2G Geared-Head Milling Machine

to 20 in. per minute. The feeds are independent of the spindle drive, both as to direction and rate of advance. The rate is controlled by two small levers on the left side of the machine and is plainly indicated by the index plate above them. A single lever, located at the front of the machine, reverses the direction of feed.

Rapid power traverse for the work table is available at all times and in either direction by the simple movement of a lever at the front of the machine. The traverse is independent of the feeds, is at constant speed, and when stopped by the lever the feed continues in the direction and at the rate of advance for which it was set before the power traverse was applied.

Hand wheels for the vertical movement of the knee and the cross movement of the saddle are conveniently located and, to preclude accidental disturbance of adjustment or interference with the power feeds, may be disconnected from their shafts at any time by means of concealed clutches in the hubs. The knee is made wider than formerly, and a 3-in. cross movement of the saddle is now obtainable with the work table swung at an angle of 45 deg. in either direction,

A separate pump supplies cutting compound for the tools from a tank located in the bottom of the column of the machine and entirely separated from the lubricating oil reservoir, which is above it. The compound flows back to the tank through channels of large cross-section and is strained in its passage to remove chips and sediment.

The working surface of the table is 48 x 12 in., and it is provided with three T-slots ⅝ in. wide. The longitudinal feed is 28 in., the cross feed 10 in., and the vertical feed 18 inches. The overall floor space required by the machine is 99x112 in. and its net weight is approximately 4,500 pounds.

Betts Combination Journal Truing and Axle Lathe

An axle lathe on which the journals may be turned with the wheels in place, as well as regular axle work, has recently been placed on the market by the Betts Machine Works of the Consolidated Machine Tool Corp. of America, Rochester, N. Y.

It will be noted from the accompanying illustration that the machine is furnished with two tool carriages for turning outside journals with the wheels in position, the center of the axle being held in the driving head. To clear the wheels when this operation is being performed, the bed has two gaps, in which separate filler blocks may be inserted when the machine is to be used as a regular axle lathe. These blocks are shown on the floor at the front of the machine. With the filler blocks in position, the carriages have sufficient travel for turning both the wheel seat and the journal fit, finishing the fillets of the axle, and burnishing.

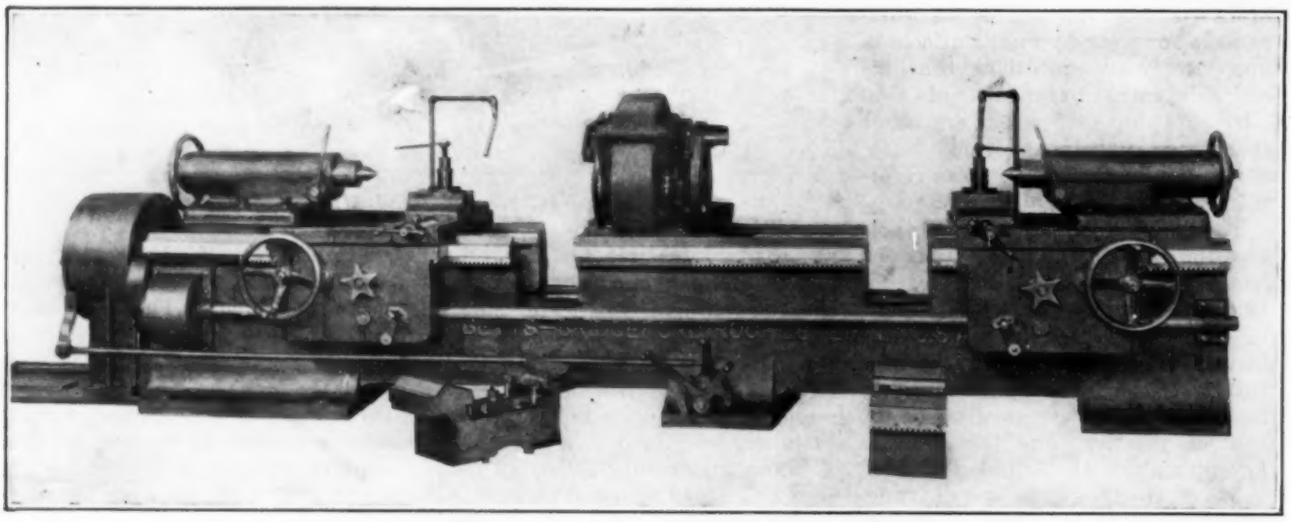
The driving head at the center is arranged to open so that axles with wheels mounted in place may be positioned on the centers. The large driving gear has coarse-pitch, wide-faced teeth, and is made in halves. It rotates in two large bronze bearings, one on either side of the center.

The driving pinion, which meshes with the large gear, runs in oil and is mounted on a heavy shaft, located in the bed and driven through the speed change gears at the left-hand end of the bed. The sliding change gears are of hardened steel, run in oil and provide three changes of speed. The speeds are changed from the center of the machine.

The power for the feeding motion of the tool carriages is delivered by a splined feed rod which runs along the front of the bed. The rod drives the carriages through a train of steel gears and a range of four feeds is available. The feeds are controlled from the center of the machine.

When the machine is driven by means of a single pulley or an a.c. motor, a powerful friction clutch and automatic brake is provided, the operation of the clutch being controlled from the center of the machine. This arrangement gives the operator complete control of the machine from his normal working position. When a d.c. motor is used for driving, a dynamic brake in the controller is used for quick stopping and is operated by means of a conveniently mounted push-button station.

The machine is furnished with a swing of either 45 or 55 in. in the gaps. Axles of various lengths can be accommodated, since both tailstocks are adjustable along the bed.



Betts Combination Journal Truing and Axle Lathe

Palmerbee Mill-Type Speed Reducer

For use in connection with conveying machinery, steel mill and similar machinery, and where direct motor drive is used in connection with heavy presses, shears, etc., the Palmer-Bee Co., Detroit, Michigan, has developed the "Palmerbee" mill-type speed reducer shown in the accompanying illustrations. The speed reducer consists of a train of gearing, compounded to obtain the desired reduction and enclosed in a cast iron housing as shown in Fig. 1. The feature of the reducer is the simplicity of design, which permits the use of wide face, coarse pitch gears, whereby a maximum of strength is obtained. All gears are of the spur type with machine-cut teeth and every shaft is supported in bearings at either end. All parts are interchangeable and, as the housing of a reducer of given size accommodates all ratios of gearing, the ratio can be increased or decreased at any time by substituting one set of gears for another.

Fig 1—Palmerbee Mill-type Speed Reducer

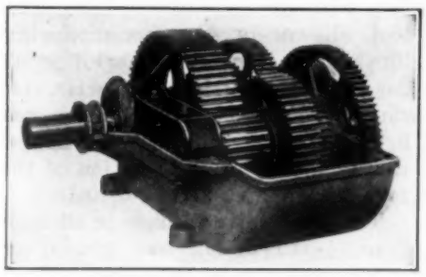
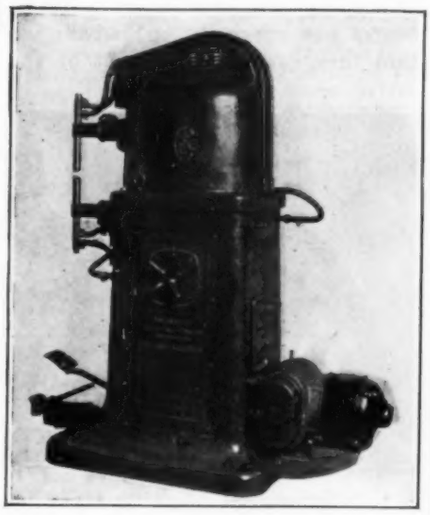


Fig. 2—Housing cover removed to show gearing

The housing is made in two parts with a machined, oil-tight joint between as shown in Fig. 2. Possibility of distortion is eliminated by the heavy, ribbed construction of the lower half of the case. The reducer is lubricated by means of a combined oil-bath and splash system, no oil nor grease cups being used. A single oiling is said to suffice for several months of normal service. The horsepower ratings of Palmerbee speed reducers range from ¼ to 200 hp., and the ratios from 4 to 1 to 400 to 1. The reducer will be furnished either with standard shaft projections, or assembled complete with flexible couplings, with or without a motor mounted on a cast iron base.

A.E.F. Motor-Driven Spot Welder

A spot welder with an automatic control that makes high-speed operation possible is now being marketed by the American Electric Fusion Corp., 2610 Diversey Ave., Chicago, Ill. The machine is adapted for a wide range of application, including production welding operations on a variety of materials, from fine wire to comparatively heavy sheet metal.



A. E. F. Motor-Driven Spot Welder

The automatic control of the machine turns the current on and off and applies the pressure, the current being used in the quantity and for the length of time necessary to complete the weld. A Westinghouse repulsion-induction type motor operating at approximately 1,100 r.p.m. provides the power for driving.

Mounted on the motor shaft is a quadruple thread worm which meshes with a worm gear, giving a reduction between motor and the lower drive shaft in the gear housing of 10 to 1. This shaft drives the mechanism through change gears, equal gears driving the welder at the rate of 110 spots per minute.

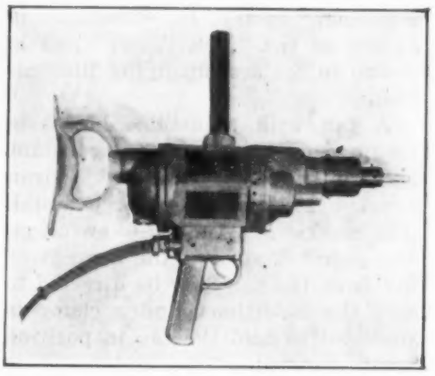
Two other change gears are provided, by means of which the machine may be operated at a minimum speed of 80 and a maximum speed of 140 spots per minute. Any other combination of gears to suit the work in hand may be use and, by substituting a double or single thread worm, a further reduction of speed down to 13 spots per minute can be secured. A quick shift attachment can be furnished if desired, giving a range from 20 to 120 spots per minute in nine steps.

A treadle is provided for starting and stopping the welder and is so designed that the operator can obtain one or a series of welds depending on the nature of the work. When the control is fully engaged, the operation is continuous.

Black & Decker No. 3 Electric Screwdriver

The Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., has recently added to its line of portable electric tools the No. 3 portable electric screwdriver and socket wrench, shown in the accompanying illustration.

The tool weighs 15 lb., and is designed for heavy duty production work, such as driving large wood screws and lag screws and running up nuts on large bolts. The spindle is equipped with a positive clutch which automatically disengages when the forward pressure on the tool is released. The pistol grip and trigger switch which characterizes other tools of this line is standard equipment also.

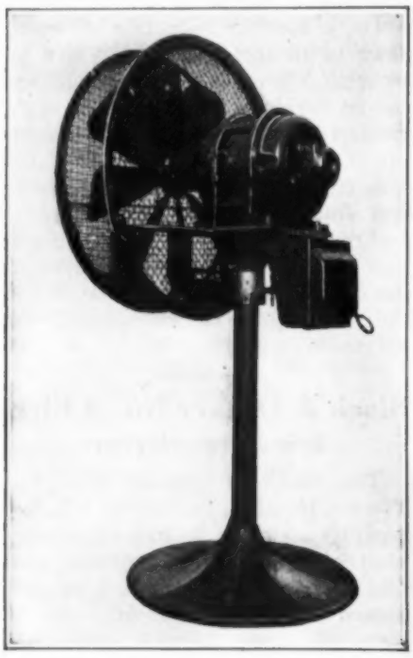


Black & Decker No. 3 Electric Screwdriver

A universal type motor furnishes the driving power and can be furnished to operate on all standard voltages up to 250 volts.

Garden City "Man Cooler" Fan

A self-contained ventilating unit, for use wherever workmen are exposed to excessive high temperatures or direct heat radiation, has recently been placed on the market by the Garden City Fan Co., McCormick Building, Chicago, Ill. The unit is known as the "Man Cooler" and is shown in the accompanying illustration.



Garden City "Man Cooler" Fan

A fan with adjustable blades is mounted on the shaft of a constant speed motor attached to a cast-iron bracket at the top of a pedestal. The bracket is arranged to swivel on the pedestal, so that the current of air from the fan may be directed to suit the conditions, and a clamp is provided to hold the fan in position when adjusted.

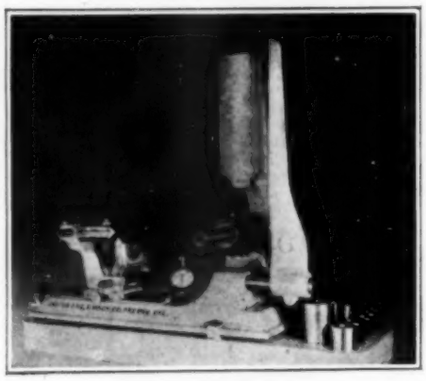
The guard for the fan and the starter for the motor are also attached to the swivelling bracket. The base of the pedestal is heavy and has sufficient spread so that the machine stands solidly on the floor. If an easily portable apparatus is desirable, the regular base can be replaced by a wheeled base provided with low wheels and a truck handle.

Although the speed of the motor is constant, it is possible to vary the volume of air delivered by adjusting the angle of the fan blades. The fan is completely guarded and protected by the screen casing, and a sheet steel casing can be furnished for use under exceptional conditions. The machine is also well adapted for emergency use in case of a shutdown of the main ventilating system.

Sulprizio's Aligning Jig

The United Engine & Machine Co., Fresno, Calif., has recently placed on the market a device for the inspection of automobile pistons and connecting rods. The apparatus is known as Sulprizio's aligning jig, and is shown in the accompanying illustration.

The purpose of the device is to give an accurate alignment of the piston, connecting rod and wrist pin. The crank pin bearing of the connecting rod is mounted on the main arbor, and the wrist pin alignment is then tested by the parallel blocks at the other end of the apparatus, as shown in the illustration. These blocks are arranged on swivels, so that they can be swung out of the way for the purpose of testing the alignment carefully by means of the dial indicator.



Sulprizio's Aligning Jig

The upright gaging surfaces are for testing the alignment of the piston, the piston, wrist pin and connecting rod being assembled and swung to a vertical position for this purpose. Another parallel, not shown in the illustration, fits over the arbor, and is used to test the alignment at the front of the piston.

The arbor is made of chrome nickel steel and casehardened to provide a smooth and accurate surface. A series of 10 bushings, ranging from 1¼ to 2½ in. in diameter, are provided for various sizes of crank pin bearings. The parallel blocks are mounted on a carriage, the position of which may be adjusted on the bed to accommodate various lengths of connecting rods.

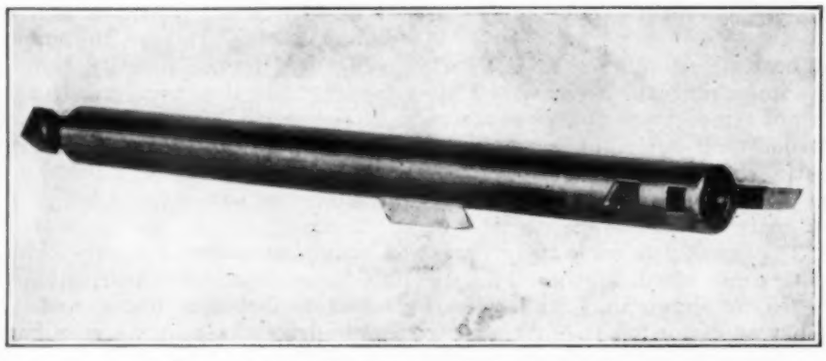
Rachard "Twin Head" Boring Bar

A boring bar, designed to make the tool-changing and adjusting operations easy and quick, has recently been placed on the market by G. Rachard, 504 E. 17th St., New York, N. Y.

The body of the bar is made of double, extra heavy, seamless steel pipe. A clamping rod for the cutting tool is arranged in the center hole, so that the clamping is done by turning a screw at the back end of the bar. The clamping screw is of sufficient size to be turned by a wrench, and considerable pressure can be applied to the tool bit, holding the bit tightly and preventing chatter.

One of the features of the tool is its ability to hold the tool bit either at right angles, or at an angle of 45 deg. with the axis of the bar. The tool shown in the accompanying illustration is holding the bit at 45 deg., and the 90-deg. crosswise hole can be seen. The same clamp rod holds the cutter in either position so that changing of the position of the tool bit is easily accomplished.

The boring bar is made in all sizes from ½- to 2¼-in., and special or extra sizes can be furnished.



Rachard "Twin Head" Boring Bar

News of the Week

Ford Plans Many Expansions During the Coming Year

More than 150 million dollars will be spent

Extensive improvement of waterways looking to the development of an all-water route from Green Island, N. Y., to Detroit; completion of a plant, the erection of which has been started, at St. Paul, Minn.; an addition to the Kansas City assembly plant, and extension of business throughout the South and West, are among the items set forth in a statement by the Ford Motor Co. in its expansion program for 1924.

An official of the company who is close to Mr. Ford was authority for the assertion that the statement covered improvements which would call for an expenditure of from $110,000,000 to $150,000,000 during the year. Regarding other extensions which will be made by the company, the statement says:

"Plans have been completed and construction is to be begun early in the year on a new assembly plant at Philadelphia.

"About Feb. 1 production is to be begun at the new Hegewitch plant at Chicago, where, in addition to the assembly of six hundred cars and trucks per day, all closed car bodies required in the Chicago district, will be manufactured.

"The West Coast is regarded as expecially well prepared to handle the large volume of business expected in 1924, as a result of additions made to the Los Angeles assembly and manufacturing plant during the past year.

"The Ford expansion program for the South is reflected in the completion in 1923 of the new assembly and body plant at New Orleans and an addition to the Atlanta (Ga.) plant. Other extensions are contemplated for the South during 1924.

MANY EXPANSIONS

"An addition will be built to tne Kansas City assembly plant, increasing its floor space 168,000 square feet, and a new sales and service branch at Salt Lake City, on which construction has begun, will be completed in April."

The increase in production of by-products from the Ford plants is also covered in the statement. In this connection it is announced that new coke ovens, now under construction at the River Rouge plant here, in which coke and its by-products will be manufactured by low temperature process, will be put into operation.

There also will be put into operation at the River Rouge plant, it is asserted, a cement plant which will make 1,000 barrels of cement daily from blast furnace slag. This cement will be used in the building operations of the company.

At the Highland Park plant of the company it is planned to extend manufacturing units and increase railroad facilities.

A new body factory and wood distillation plant will be put into operation early in the year at Iron Mountain, Mich. Here the timber will be finished for automobile bodies, and in addition wood alcohol, wood tar, gas, oil and charcoal will be manufactured from the pieces too small for use in automobile body manufacture.

Increased production is also forecast for the company's plant at Flat Rock, Mich., which manufactures automobile lamps. The Ford wheel plant at Hamilton, Ohio, the statement says, will be increased to keep it "abreast of growing requirements."

In regard to the proposed all-water route from Green Island, N. Y., to Detroit, the statement says:

"Buildings for the new Ford plant at Green Island, N. Y., are now completed and production of gears, radiators and other parts begun last year, will be expanded as additional machinery is installed. Extensive improvement and development of waterways in the Green Island district are also under way, looking to an all-water route to Detroit."

Truscott Will Speak at S.A.E. Meeting

Starr Truscott, aeronautical engineer of the U. S. Navy, will reveal for the first time the complete story of the designing and building of the Navy airship Shenandoah (ZR-1) at the annual sessions of the Society of Automotive Engineers which will be held in Detroit, Jan. 22-25, during the Detroit automobile show.

This airship is considered the greatest of its type in the world. Its recent successful flights marked a distinct progress in the science of aerial navigation. Nearly 700 feet long, it is truly a giant of the air, with a total lift of 140,000 lb. It is powered by six great six-cylinder engines, which were built in Detroit especially for this purpose.

In the projected flight of the Shenandoah over the unexplored Artic ocean north of Alaska, it is expected that the discoveries of cold waves will be of great value in forecasting the American weather, Major E. H. Bowie, supervising forecaster of the U. S. Weather Bureau, has stated.

Many new and unusually difficult problems were encountered in building this craft and it is these problems that Mr. Truscott will discuss. It is believed that the address will be one of the most interesting at the sessions, holding as much popular as technical interest.

Lieutenant A. J. Lyon of the U. S. Air Service, Dayton, Ohio, will give an address on the new developments in light alloys for airplane engine parts.

Professors G. A. Young and J. H. Holloway of Purdue University will give a paper on detonation control; A. M. Dean, C. A. Kirkham and John W. Swan will read a paper on fundamental improvements on manifold design. C. S. Kegerieis of Purdue University will talk on carburetor characteristics. These are but a few of the dozens of speakers who will give addresses.

Machinery Exports in November

Exports of metal working machinery during November, 1923, with revised comparative figures for November, 1922, as compiled from the returns to the Department of Commerce, were as follows:

	NOV., 1922, Value	NOV., 1923, Value
Lathes	$41,123	$151,003
Boring and drilling machines	57,670	75,555
Planers, shapers and slotters	19,975	19,500
Bending and power presses	12,417	64,000
Gear cutters	11,707	65,656
Milling machines	33,118	36,871
Thread cutting and screw machines	34,926	12,672
Punching and shearing machines	2,848	6,961
Power hammers	11,820	12,821
Rolling machines	93	9,346
Sharpening and grinding machines	72,460	130,381
Chucks, centering, lathe, drill and other	14,136	28,056
Reamers, cutters, drills, taps, dies and other metal-working tools	80,303	153,629
Pneumatic portable tools	53,753	85,637
Foundry and molding equipment	49,368	21,626
Other metal-working machinery and parts of	431,323	392,634
Metal-working machinery	$927,040	$1,266,348

Freight Car Orders Received

Much interest has been shown in the trade in freight car orders, a very fair average having been maintained lately, counting in the Southern Pacific's business, just placed. This amounted to 6,555 cars, of which 1,075 will be built in the road's own shops. With some smaller business reported in the past week a total of about 17,000 freight cars has been placed in five weeks, representing a rate of over 170,000 cars a year.

Cleveland Confident Year Will Yield Good Proportion of Business

Optimistic yet conservative is Brophy's prediction

Leading machine tool factors in Cleveland are optimistic for the immediate future, but this optimism is tempered with conservatism begotten of facts fairly faced. The opinion of J. P. Brophy, general manager, the Cleveland Automatic Machine Co., perhaps best expresses the sentiment of the trade in this vicinity.

Figures prepared by Mr. Brophy indicate that the effects of the war have not been entirely wiped out, as far as the machine tool manufacturer or distributor is concerned. It is shown that, while there is a steady gain in new business, this gain is decidedly slow. In 1921, the industry showed an outlet of 10 per cent of normal; in 1922, 25 per cent; and in 1923, from 40 to 65 per cent of normal, with the bulk of the business done in the first six months of the year. This last is borne out by the fact that in an interchange of information on machine tools wanted by industrial operators, not a few factors report practically nothing required in the way of new equipment, while the few inquiries that have sifted into this market are zealously guarded by the recipients.

While mild enthusiasm is shown for the gains in the machine tool outlet of the heavier kind, and this primarily to the railroad shops and like consumers, the bigger bulk—and this represents about 80 per cent of the production according to Mr. Brophy—is in lighter equipment, and it is here where the Cleveland trade, as well as that in other sections of the country, has shown the lesser improvement.

Meanwhile the possibility that 1924 will develop an improved outlet for new equipment comparable to the gains made in 1923 over the year before is apparent from the program of activities outlined by manufacturers as a whole. Locally the automotive industry still holds the best for the machine tool builder. Most plants have closed temporarily for the usual inventory. Most of these also will start up again early in the new year, with a schedule of outlet for cars that is in excess of that of last year. At the same time this favorable condition can be used to offset the slower outlet for trucks, demand for which appears to be not up to a year ago, although still fairly strong.

While there may be less opportunity for export business in machine tools themselves, the probability that new business may find a reflection in foreign demand for American-made products in which the equipment itself may figure is shown in the report of Charles E. Thompson, president of the Steel Products Co., just back from Europe. It is his opinion that Cleveland-made parts for European airplanes may yet find a favorable market abroad. Mr. Thompson has been visiting England, France and Belgium to interest engine builders there in a new valve made by his company. He reports many orders placed, and tests being made before other orders are given. It is Mr. Thompson's belief that, as far as aircraft manufacture in Europe is concerned, there is better opportunity for the American manufacturer now than a year ago.

Following the booking of new business in the last few weeks, the Berger and South Division plants of the United Alloy Steel Corp. has reopened ten sheet mills. These mills have been closed for the last few months and their opening is significant.

Southern Markets Are Quiet

Conditions in the machine tool business in the Southern territory during the last ten days of December were quiet and comparatively few sales of any consequence were made during the period by the Atlanta dealers and jobbers.

Generally, nearly the whole South appears to be in a prosperous condition financially, though there are some districts that show a decidedly spotty tendency. Salesmen state that industrially the South has been very active of recent months, and that all indications portend continued activity through the first half of 1924. The principal industrial activity is in Georgia, Alabama, North and South Carolina and eastern Tennessee, though in the extreme Southern parts of Alabama and Georgia things are not as prosperous. The cotton crop was a failure in the extreme South, and this will have its affect on industry during the present year. In the other districts, however, where the crop was close to normal, all industry is very active, and business generally prosperous, due to the excellent cotton prices that have prevailed during the past few months.

Regarding the South as a whole, however, salesmen covering the territory for machine tool dealers in Atlanta are very optimistic over the 1924 outlook, and expect a steady volume of trade to materialize during the next few months.

Inquiries of the past two weeks have been comparatively heavy for tools, with the textile industries showing an increased interest from week to week, and many railroad companies of the district asking data, prices, etc., on heavier equipment for shops. As was the case during most of December, the smaller machine shops are also showing more interest, and dealers are expecting to book a fairly good volume of business in this field during January to March, due to the fact that these smaller shops did comparatively little buying during the last quarter of 1923. Inquiries being received from such shops indicate that they are in the market or at least interested in a fair amount of equipment of varied types, with some inquiries for heavier lathes, drill presses and such equipment. Garages and service stations of the Southeast also are showing quite a bit of interest lately in equipment of the latter type, and good sales also are expected to materialize in this field.

Cotton oil mills, lumber plants, planing mill and woodworking plants are among other industries in the South beginning to show signs of increased interest, and though the trade is not counting on much from these fields they are expected to prove somewhat better than during the last three or four months of 1923.

Steady Buying in Chicago Market

While the anticipated increased machine tool buying has not made its appearance during the first few days of the new year, dealers are optimistic and there is a general feeling that some good business will be secured this month.

A local engineer purchased from Jos. T. Ryerson & Son, Chicago, a 25-in.x 18-ft. lathe, a 14-in. shaper and a 6-in.x6-in. hacksaw for the Ohio Ridge Edison Co., Toronto, Ohio. The Atlantic Steel Co., Atlantic, Ala., purchased two punches and two special mill type shears; the Chicago Manufacturing & Distributing Co. bought a 12-in. punch, 7¼-in. capacity through 1-in. hole; the City of Chicago, Dept. of Gas and Electricity purchased a Beloit No. 54 punch and shear and a hammer and pipe threading machine. The Lyon Boiler & Machine Works, Smackover, Ark., purchased a flue cleaner and flue welding machine.

The Sugar Land Ry. placed orders for about five machine tools totaling about $5,000, including a Ryerson 17-in. x8-ft. lathe. The Pere Marquette Ry. has purchased light jib cranes from the Whiting Corp. The Chicago, Burlington & Quincy R.R. is reported to have purchased two 54-in. vertical boring mills, two pattern makers' lathes, and two guide-bar grinders. The Kansas City Southern R.R. placed an order for an 18-in. motor driven engine lathe, a 12-ft. plate flanging clamp and a 400-ton car wheel press. The New York Central R.R. purchased one axle lathe and two engine lathes. The Southern Ry. has issued an inquiry for 51 machine tools, 70 No. 90, 47 No. 80 and 40 No. 60 pneumatic riveting hammers. The list includes lathes, bolt cutters, vertical boring mills, planers and milling machines.

Quite a number of Chicago dealers were closed on the Monday preceding New Years' Day. Most of them are busy taking inventory.

Orders for Rollin Car

Cleveland's newest automobile manufacturer, the Rollin Motors Co., reports that orders for the new Rollin car have gone to 30,000 for 1924, though plans call for a production of but 20,000. A plant has been established in Euclid Village, East of Cleveland proper. Rollin H. White, with connections with the White Co., is chairman of the board of the new company. This car is conceived along European lines and it is expected to sell at moderate price. It was shown publicly at the New York automobile show for the first time and much interest was created by its appearance.

Philadelphia Buying Is Resumed

Philadelphia machine tool manufacturers are more hopeful for an early revival of business than they have been for months. Inquiries received by the city's largest producers show industry generally is leaning toward a resumption of buying on a substantial scale.

Virtually all of the Eastern railroads have heavy budgets for shop and other equipment for 1924 purchases, according to information reaching sales departments of manufacturers. The directors of the roads have not passed on these appropriations, but there is a hopeful feeling throughout the industry that many of them will act favorably.

Many of the leaders in the industry in Philadelphia attribute this apparent early resumption of buying to the favorable manner in which the Mellon tax reduction program has been received by members of Congress. With a large part of the tax burden lifted, the industry sees the way cleared for a large measure of business progress.

The general outlook in all lines is much better than it was in November and December and hopes for further improvement are bright.

Public utility companies have been fairly large purchasers of machinery in the Third Federal Reserve District, the monthly statement of the Reserve Bank shows. The steel market is quiet and no general increase in demand is expected until later in the year. Requests for iron and steel castings are fewer now than they were at this time last month. Most of the sales have been made to crane builders and building contractors. The demand for light and heavy hardware has been fairly good.

Cincinnati Trade Is Steady

Production in the machine tool plants of Cincinnati during the last half of December dropped off somewhat due to the holiday season and to the inventory period. There are individual instances of plants that have done better during the second than the first half of the month. Manufacturers feel that the first quarter of 1924 will bring more orders than were received for the same period of 1923. One large manufacturer stated that his business for the immediate future, judging from inquiries he is receiving and from quotations outstanding, will probably be better than at any time in the past few years. It is this spirit of optimism that has manifested itself among many of the Cincinnati manufacturers that leads to the prediction that the next three months will bring good business.

The automobile industry has not been quite so active in making purchases here in the past ten days. It is likely that heavier purchases from this source will be made by Jan. 15. Several local plants report that their orders from the automotive field have held up well through the holiday period, while others state that the automobile companies are waiting until well into January to place their orders. Railroads have not been active purchases recently, although some of the local plants expect orders to be placed soon by certain roads.

Milling machines and lathes have been in fair demand with inquiries indicating that an improvement may be anticipated in the near future. Planers have been selling well. Inquiries have also been brisk and the outlook is for steady production throughout January. Cutting grinders have had a fair market.

Electrical tool firms report that the past two weeks have been satisfactory and, in several instances, production has increased over the early part of December. Buying of electrical tools by the automotive industry has slackened. There are many quotations standing out and manufacturers believe that good production will be maintained for the next month. Woodworking machinery concerns state that orders have been good and that they are operating their plants on a full time basis. Conveying machinery holds up to a high level of production with no indications of a diminution in orders in the immediate future.

Foundry operations are curtailed and manufacturers seem to be endeavoring to hold down inventories. This makes conditions in the iron market quiet, both as to new orders and shipments. Some of the foundries closed down during the holiday period.

Cincinnati machine tool houses are in a good position as far as the labor situation is concerned. The peak of the unemployment during 1923 in Cincinnati was reached in December.

Acknowledgment of Seasonal Cards

Christmas and New Years cards from the following are gratefully acknowledged by the *American Machinist*:

The Cincinnati Planer Co., Cincinnati, Ohio; Mason & Moore, New York City; the American Bosch Magneto Corp., Springfield, Mass.; the Acme Machine Tool Co., Cincinnati, Ohio; Battey & Kipp, Inc., Chicago; the Bausch & Lomb Optical Co., Rochester, N. Y.; Office, Chief of the Air Service, U. S. A.; the Collis Co., Clinton, Iowa; the Armstrong Bros. Tool Co., Chicago; the Norma Co. of America, Long Island City, N. Y.; the Advance Furnace & Engineering Co., Springfield, Mass.; E. C. Atkins & Co., Indianapolis, Ind.; the Delta File Works, Philadelphia, Pa.; the Kempsmith Manufacturing Co., Milwaukee, Wis.; the Philadelphia Gear Works, Philadelphia, Pa.; the Link-Belt Co., Chicago, Ill.; the Whitman & Barnes Manufacturing Co., Akron, Ohio; the American Tool Works Co., Cincinnati, Ohio; and Kadel & Herbert, New York City.

Philadelphia Foundrymen Hold Meeting

A dinner and meeting of the Philadelphia Foundrymen's Association, Inc., was held Wednesday evening, Jan. 9, at the Manufacturers' Club. Several speakers were heard, among them, A. C. Dinkey, president of the Midvale Steel & Ordnance Co., Nicetown, Philadelphia. With the aid of motion pictures the Midvale plant was shown in full operation and the pictures were explained by Mr. Dinkey. George E. Buxton of Pottstown also spoke on the economic conditions of the present time. Regular business was transacted.

Business Improves in New York

Machine tool dealers in the New York district report that the expected business has already started and that the first week in the month showed remarkable business as compared with other years. The number of inquiries in the Metropolitan district during December was much more than at first estimated and dealers state that the month in general proved to be an average month, whereas it was not expected that business of any kind would develop during the latter part of the month.

Attention is turning toward woodworking machinery and the needs of the automobile parts builders in this section of the country. Closed bodies have been decreed and this brings into play many more machine tools and machinery than was formerly used in the production of automobiles. The factories of the East have been inquiring for all sorts of machine tools and body builders in this section have also asked for many quotations. At the outset of the year this source looks to be the most likely of any to the machinery and machine tool dealers.

General industries have purchased some machine tools already this month and more buying is anticipated for the latter part of the month. The General Electric Co. has made a few more purchases for the Schenectady shops. Dealers are watching carefully any developments at the Kearney plant of the Western Electric Co. and it is expected that the machinery requirements will be forthcoming within a few weeks.

Exporters report excellent business due to the unseasonable weather. Exporting has improved within the past two months and those who are authority on the subject state that machinery and machine tool exporting will show improvement during this year.

Bethlehem Stops Making Ordnance

The Bethlehem Steel Corp., which devoted all its efforts during the war to the production of munitions and other ordnance materials, and which prior to the war was the largest producer of ordnance materials in this country, has rearranged its entire production schedule to strictly commercial steel products, according to a statement issued recently. This, however, does not include the emergency ordnance plants, which represent only about 2 per cent of its entire property and plant investment.

Celebrates Its Fortieth Anniversary

The Cincinnati Milling Machine Co. celebrated recently its fortieth anniversary with an entertainment at Emery Auditorium, Cincinnati, which was attended by both the employees and the officials of the company. Fred Geier, president, aided by Otto, Philip and Walter Gier and C. Wood Walter, all officials of the company, formed a quintet and sang humorous songs. Gifts were distributed to all employees and their families.

Mellon Explains the Tax Reduction

With exceptional clarity, the Mellon tax reduction proposal is explained by a series of comparisons by Andrew W. Mellon, Secretary of the Treasury, in the recent issue of the *Outlook*. Mr. Mellon shows that a high rate of taxes does not necessarily mean a large revenue to the government and that more revenue may often be obtained by a lower rate. He cites the plan that is followed by men like Ford in quantity production at a small profit rather than at a larger profit, but with a more limited appeal.

"With the principle that a man should pay taxes in accordance with his ability, I thoroughly agree," states Mr. Mellon, "but when, as a result of an unsound basis of taxation, it becomes evident that the source of taxation is drying up and wealth is being diverted into unproductive channels, yielding neither revenue to the Government nor profit to the people, then it is time to readjust our basis of taxation upon sound principles.

"Your Government is just a business, and can and should be run on business principles. An income tax is the price the Government charges its people for the right to make a taxable profit. Experience has shown that the present high rates of surtax are bringing in each year progressively less revenue to the Government. This means that the price is too high to the large taxpayer and he is avoiding a taxable income by the many ways which are available to him. What rates will bring in the largest revenue to the Government, experience has not yet developed, but it is estimated that by cutting the surtaxes in half, the Government, when the full effect of the reduction is felt, will receive more revenue from the owners of large incomes at the lower rates of tax than it would have received at the higher rates. This is simply an application of the same business principle, just as Mr. Ford makes more money out of pricing his cars at $300 than at $3,000."

Mr. Mellon further states that lower surtaxes are essential if the present prosperity of this country is to be continued and that by lower taxes, securities that have been tax-exempt will become less popular to the investor who will turn his wealth toward industry.

Apprentice Schools in France

The precision tool industry in France is soon to have its apprentice school like many other trades of a considerable more magnitude. The need in France, in all mechanical lines, is for the highly educated and trained specialist. It is probable that in no country on earth is there such a proportionate dearth, said to come largely from the fact that technical education is often too general, an engineer being one with a degree, but who may according to circumstances hire his talents to a shipyard, a match factory or a bauxite mine. Such at any rate is the statement made by a mining engineer in the south of France who was seeking assistance and found only one who was an all-embracing engineer, an engineer of everything. If this be literally the case the situation explains itself.

The important industry of precision tools is to have its apprentice school as a result of an endowment of 300,000 francs from Monsieur Jules Richard. The city of Paris on its part offers a school building.

The administration will be jointly in the hands of representatives of the founder, the municipality and of the Syndicate of Precision Tool Makers, under the general supervision of an inspector general of the government bureau of technical education. The course will cover three years and instruction will be gratis.

News of Washington Activities

By Paul Wooton

Legislation whereby the Federal government may license for commercial use thousands of patents that it holds and which is designed to encourage the inventive genius of government employees by providing compensation for their discoveries and developments while at the same time providing a means of protecting inventions valuable to the national defense is recommended in the report of the Interdepartmental Patents Board.

The report of the Board has been transmitted to Congress by President Coolidge and referred to the patent committees of the House and Senate.

After discussing the present confused situation affecting inventions by employees of the government and disclosing the fact that more than 30,000 patents are held by the Federal government without Congressional authority to put any of them into commercial use, the Board recommends enactment of two laws to relieve the situation, enclosing with its report suggested bills embodying the ideas of the Board as to what these laws should be.

One of the suggested bills would authorize the President to constitute a permanent Interdepartmental Patents Board to be composed of one representative from each Department or independent establishment which in his judgment is entitled to representation, the members of the Board to serve without additional compensation. This Board would act as the sole agency through which all patents and patent rights hereafter would be conveyed to the government, and would control and administer all such patents in behalf of the government.

The second bill suggested by the Board is an act to authorize the issuance and withholding and secrecy of patents essential to the national defense. It would authorize the President, or an agency designated by him, whenever the publication of a patent would be prejudicial to the national defense to order the patent sealed and kept in a secret file. The patent would be forfeited if published in violation of secrecy or if an application for a patent were filed in any other country without consent of the President or his agency. It would provide that upon failure of the patentee to agree with the President or his designated agency as to reasonable compensation, the patentee would have the right to sue the government in the Court of Claims, the proceedings, if requested by the government, to be secret.

"Many technical ideas that arise during the scientific work of the government bureaus might be developed into valuable inventions, but are now lost because of the want of a proper patent policy clearly defining the inventor's status and thus removing obstacles to the full development of his talent," reads the report. "Many inventions that do take tangible form merely find place in technical publications and are developed no further toward useful application."

Abolishing Tax-Exempt Securities

Whatever may be the fate of the tax revision bill, the subject has served to focus attention upon tax-exempt securities and undoubtedly has strengthened the ranks of supporters of submission of a constitutional amendment to abolish further issues of securities free from taxation.

A resolution for the submission to the States of this proposed amendment to the constitution was one of the first measures introduced when the Sixty-eighth Congress met. Its author, Representative Green of Iowa, chairman of the Ways and Means Committee, has stated that it will be considered by that committee as soon as the revenue bill and the bonus bill are disposed of by the committee. A canvass of members of this committee assures a favorable report.

In the last Congress a combination of Southern and Western members of the House was able to defeat passage of a similar resolution. Their argument was, and is, that the more developed sections of the North and East have accomplished major improvements by issuing securities at low rates of interest because of the tax-exempt feature of the bonds and that the other sections should not be denied the same advantage now that they are in a position to push public works.

Senator Oddie Studying Coal Report

An intensive study of the report of the Harding Coal Commission is being made by Senator Oddie, of Nevada, the chairman of the Committee on Mines and Mining, with the idea of translating into legislation such of the recommendations as may meet his approval. He has not proceeded far enough with the study to determine just the form this legislation will take. It is entirely probable that it may incorporate certain suggestions which have been made since the report of the Coal Commission was issued.

It is a relief to many, who are deeply interested in the best interests of the coal industry, to know that the legislation to grow out of the Coal Commission's report is to be handled by a legislator who is entirely constructive in his tendencies. For that reason, it is very safe to assume that the administration measure will not come out as full of teeth as a corn shredder, vesting the Federal Trade Commission with powers to conduct a new program of regulation of the punitive type. Senator Oddie may be relied upon to bring out constructive legislation which will seek to foster and promote the coal industry along the lines that will enable it to furnish better service to the general public.

French Foreign Trade Improving

Figures show Great Britain to be a spirited buyer—Export business will be encouraged—Germany unable to compete in French markets—Machine tools needed

By a Paris Correspondent

THE OUTCOME of the British elections has been awaited with the keenest interest in France, whose growing trade with the United Kingdom has been one of the outstanding features of the French industrial improvement during the past year. Now that British electors have pronounced themselves in favor of a continuance of the traditional free trade policy, there will undoubtedly be a considerable amount of rejoicing in French industrial circles.

From the French viewpoint it has from the beginning seemed strange that British politicians should expect to find in the imposition of tariff duties a panacea for the unemployment problem, which the French are inclined to believe is due more to the foreign policy of the British Government than to any other single cause. The British foreign policy, say the French, has acted directly to artificially depress the value of French, Belgian, Italian and German currencies, thereby not only handicapping British exporters in the markets of the world, but at the same time automatically opening the markets of the United Kingdom to products from these countries and accentuating the unemployment difficulties inherited from the war. The only cure for this situation, the French believe, is in remodeling the British foreign policy so as to bring Great Britain back into the fold of the Allies as an active collaborator in the untangling of the Central European knot; which means, of course, forcing the Germans to pay.

Whatever may be the true reasons back of the slackness of British trade as compared with that of France, it seems reasonable to admit that the depreciation of the French and Belgian franc has tended to greatly strengthen the power of French and Belgian manufacturers to undersell the British in the markets of the world. With the pound sterling quoted at 82 francs and the dollar at 18 to 19 francs, it is reported that the textile mills in Lille are working three shifts of eight hours each, that there is no unemployment and that large stocks are being accumulated in preparation for an active campaign for foreign business.

French Iron Report

In the metallurgical industry, the reports are equally encouraging. The number of blast furnaces working on Nov. 1 was 116, as compared with only 77 in March, a few weeks after the occupation of the Ruhr. The October output of pig iron—514,000 tons—was practically the same as that of December, 1922, while in the case of steel an even more favorable situation is shown, the October production being 477,000 tons, or slightly over 60,000 tons more than in December, 1922. In other words, the metallurgical industry has completely recovered from the setback that resulted from the occupation of the Ruhr and is well on the way to a more substantial development, with a very much larger market to cater to than was the case a year ago.

The interest which the French are beginning to take in the subject of greater foreign markets for French products is evidenced by the recent meeting of the National Committee of the Foreign Trade Council, at which M. Poincaré, the Prime Minister, spoke as follows: "You, better than anyone else, are in position to assure the prompt return of the country to prosperity. By increasing production and developing our exports you will not only bring riches to us and increase our prosperity, but, what is even more important, you will extend our moral influence, affirm our spirit of pacifism and popularize the French name abroad." Senator Jouvenel, at the same meeting, added: "Our metallurgical industry which before the war produced five million tons can now produce eleven million tons. France is therefore obliged to follow a policy of expansion."

Foreign Trade Increasing

The statement that the French foreign trade is increasing is borne out by the statistics for the first ten months of this year, which show total imports for this period of 23,177,000,000 francs, as against 16,732,000,000 francs last year, and total exports of 21,167,000,000 francs as compared with 14,937,000,000 francs in 1922—an increase of 40 per cent in imports and 42 per cent in exports.

Exports to Great Britain exceeded imports from that country by 620,000,000 francs and represented a substantial increase over last year's figures. The largest buyers of French products in the order of their importance as customers were: Great Britain, 4,919 million francs; Belgium, 4,687 million francs; United States, 2,057 million francs; Switzerland, 1,643 million francs, and Algeria 1,635 million francs. It is significant that France's exports this year to the Argentine were more than double last year's figures, being 517 million francs as against 240 million francs in 1922. Evidence of the growing importance to France of her colonies is offered in the figures of exports to them amounting to 3,209 million francs and imports from them of 2,444 million francs.

The total adverse trade balance of 2,010 million francs, or roughly $111,000,000, is probably more than offset by the constantly growing amounts spent in France by tourists. While no effort has thus far been made to gather and publish accurate statistics on this subject, owing to the difficulty of obtaining such figures, it is believed by those who are interested in this invisible source of revenue (invisible because of the fact that official statistics cannot be kept) that the money annually spent in France by travelers from other countries exceeds $100,000,000 by a substantial margin, and that when the time eventually comes when the outgoing and incoming trade are balanced, the item of tourists' expenditures in France will represent a handsome profit for the nation. It is also believed that in the absence next year of acute political troubles in Europe, the adverse trade balance will be wiped out by a further marked increase of French exports.

The increased industrial activity in France has not failed to have its effect on the shares of French manufacturing enterprises and there have lately been numerous increases in the market quotations of shares of prominent concerns.

Many of the metal-working plants are issuing heavy lists of machine tools that they intend to purchase and the character of these lists indicates that if their needs are to be satisfied, importations from the United States and other countries will be necessary. The machines that are principally in demand are plain, universal, surface and crankshaft grinders, turret lathes from 1¼-in. to 3-in. bar capacity, plain, universal and vertical milling machines, and gear cutting machines. Automatic screw machines, of which there was a pronounced surplus several months ago, are now in demand and the principal makes of good second-hand four-spindle machines have disappeared from the market. It is estimated that there are on the market inquiries for at least 100 four-spindle machines more than can be satisfied by the available supply.

A curious fact in connection with recent quotations of German machine tools is the universal practice of giving prices in dollars. Practically all German manufacturers now quote prices in American currency. Their prices are high and when converted into francs and the high rate of import duty on German manufactures is added they are, in most cases, not attractive to French buyers.

Peerless Motor Co. Has New President

At a meeting of directors of the Peerless Motor Car Co., Cleveland, resignations of R. H. Collins, as president and general manager, and W. H. Collins, as vice-president, were accepted. D. A. Burke was elected vice-president and general manager, having been manager of sales. H. C. Robinson, vice-president of the Guardian Savings and Trust Co., becomes a director in the place of W. H. Collins. R. H. Collins remains as a director. The company will go ahead with the production of the six cylinder car, which will be known as the Peerless, not the Collins, and as far as the public is concerned, will make its debut at the New York automobile show. Business of the company for 1923 shows a gain of approximately 20 per cent over 1922. The company will continue to make the eight cylinder car, but to what extent it will develop the newer product has not yet been decided.

Business Items

The Kearney & Trecker Corp., Milwaukee, Wis., has closed its store and showroom in Cleveland and has opened an office in the new Penton Building, West Third St. and Lakeside Ave.

The Fafnir Bearing Co., New Britain, Conn., has purchased the May and Reynolds Properties, formerly occupied by the Hart & Cooley Manufacturing Co. of that city.

Among the Cleveland plants planning expansion during the new year is the Interstate Foundry Co., specializing in gray iron castings. In addition to operating its A plant here the company has reopened its B plant and already has booked considerable business in standard castings for the automotive trades, as well as for steel truck wheels. The increased tonnage booked recently warrants immediate increase in production. In connection with improvements made are the added cupola, crane and core room capacities. Officers of the Interstate include C. A. Fleicher, president; Robert H. Finkernagel, general manager, and Herbert Lawrence, secretary.

The Advance Rumley Co., La Porte, Ind., has acquired the Aultman & Taylor Machinery Co. of Mansfield, Ohio. The latter institution has been operating for more than fifty years, making principally threshing machines and tractors. The plant is expected to be moved to Richmond, Ind. The sale includes patents, stock, accounts and good will, but not the real estate holdings.

Fire on Jan. 1 partially destroyed the Barnhardt-Davis Co. foundry at Warren, Pa. Loss is estimated at $50,000. The blaze began in the boiler room about 9:30 p.m. and spread rapidly.

Effective Dec. 29, 1923, the prices on ¼-in., ⅜-in., ½-in., ¾-in., and ⅞-in. heavy duty portable drills manufactured by the Black & Decker Manufacturing Co., Towson, Md., will be reduced approximately 12 per cent and the prices on 4-in. and 6-in. portable electric grinders will be reduced the same per cent, according to a recent announcement sent out by the company.

The Mobile & Ohio Railroad Co. has been authorized by the Interstate Commerce Commission to purchase five locomotives and 1,000 box cars to cost $2,098,000.

The Kentucky and Indiana Terminal Railway Co. has been authorized to issue $217,000 in first mortgage bonds for the purchase of five switching locomotives, to cost $43,400 each. The locomotives will be manufactured by the Lima Locomotive Works.

The Thomas Corcoran Manufacturing Co., Cincinnati, Ohio, will erect a factory building to cost $100,000. The structure will be of brick and concrete and will be built on Spring Grove Avenue.

The new five story addition to Jenkins Brothers factory on Water St., Bridgeport, Conn., is completed and ready for occupancy. It is officially announced the new unit will start work on the first of the year.

The Minneapolis office of the Armstrong Cork & Insulation Co., Pittsburgh, Pa., is now located at 316-318-320 Third Ave. North.

Dwight P. Robinson & Co., Inc., have been authorized to design and construct extensive additions to the shops of the Southern Railway Co., at Birmingham, Ala. The work includes locomotive repair shops, boiler and smith shop, car repair sheds, mill shop, power plant and other buildings.

Obituaries

HERBERT E. CUSHMAN, aged 61 years, treasurer of the Morse Twist Drill Co., New Bedford, Mass., died suddenly Dec. 27 in his home in that city. Mr. Cushman had been confined to his home for a few days due to what had been diagnosed as a mild indisposition which was not considered serious. Mr. Cushman was born in Taunton, Mass., and commenced his business career with the Taunton Locomotive Works. For about six years and until 1887, he was connected with the Williams Manufacturing Co. In 1887 he accepted a position with the Morse Twist Drill Co., and in 1902 he was elected treasurer. He was very active in civic and fraternal centers and was president of the New Bedford chapter, Sons of the American Revolution, ex-president of the New Bedford Board of Trade, a member of the American Society of Mechanical Engineers, the Machinery Club of New York, several country clubs and Masonic orders. He was a director of the New Bedford Foundry & Machine Co., a director in two banks and two insurance companies.

J. F. MORGAN, secretary and treasurer of the Jackson Iron & Steel Co., Jackson, Ohio, died recently at his home in that city, aged 81 years.

PARK G. MYERS, aged 36 years, president and general manager of the Canton Signal & Sign Co., Canton, Ohio, died recently at his home in Canton. He left college in 1903 to become production manager of the American Steel Foundries Co. in Alliance. Later he developed and patented a safety road signal, which is in use throughout the United State. Seven years ago he organized the Canton Signal & Sign Co. and he was president and general manager of the organization at his death. His wife and two daughters survive.

JOHN MUSTARD, aged 56 years, died recently at his home in Philadelphia. Mr. Mustard was the Philadelphia representative of the Wagner Electric Manufacturing Co., St. Louis, Mo. He was well known among men in the electrical industry and had been connected with various concerns during his business life.

CHARLES R. DOUGHERTY, aged 51 years, for the past three years working in the financial interests of the General Electric Co. on the Pacific Coast, died Nov. 27 at his home in Pasadena, Calif., following a short illness.

Personals

H. W. DUNBAR, sales manager of the Norton Co., Worcester, Mass., has sailed for Cuba, where he expects to say for a month or six weeks.

FREDERICK A. HALSEY sailed last week for South America on a pleasure trip.

A. W. GRAY, formerly works manager, has been made general manager of the Bristol Brass Corp., Bristol, Conn.

JOHN F. WADE, formerly general manager of the Bristol Brass Co., Bristol, Conn., has been put in charge of the real estate holdings of the company.

J. W. BLACKFORD has resigned his position as assistant to the president of the Consolidated Machine Tool Corp. of America. For the present his address will be 83 West 188th St., New York.

J. W. MCIVER has been appointed to the position of advertising and publicity manager of the Edison Lamp Works of the General Electric Co. at Harrison, N. J., to succeed T. J. MCMANIS, newly made assistant to the manager of the publicity department of the entire company.

E. E. HELM, recently appointed district manager at Detroit of the Bridgeport Brass Co., Bridgeport, Conn., was for two years manager of the industrial bureau of the Chamber of Commerce, Akron, Ohio.

NICHOLAS M. DUCHEMIN has assumed the duties of general superintendent of the West Lynn plant of the General Electric Co. following the death of William J. Lloyd on Oct. 28. This follows an announcement recently made by F. P. Cox, manager of that plant.

JOSEPH KAYE WOOD, development engineer with the Western Electric Co., 463 West St., New York City, has been appointed chairman of the Special Research Committee on spring design of the American Society of Mechanical Engineers.

ROBERT M. CARTER, for the past several years sales manager for the Kempsmith Manufacturing Co., Milwaukee, Wis., has resigned to become sales manager for the H. A. Smith Machinery Co., Syracuse, N. Y. Mr. Carter has been well-known throughout the machinery field for many years, having served as production and sales executive with such firms as the Anchor Belt Co., Poughkeepsie, N. Y., the Chain Belt Co., Chicago, the Peru Castings Co., Peru, Ind., the Gisholt Machine Co., Madison, Wis., and the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

M. A. SHERRITT has resigned from the Sherrit & Stoer Co., Philadelphia, machine tool dealers.

E. RIVETT, founder of the Rivett Lathe & Grinder Corp., Boston, Mass., sailed for Italy Jan. 5. Mr. Rivett sold his interest in the corporation some years ago and is taking a well earned vacation.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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LIKE Banquo's ghost, the spectre of European insolvency will not down. Heralded by a sharp decline in francs and sterling it reappeared last week. On Thursday demand bills on London sold at 4.25½ and cheques on Paris at 4.88.

This weakness in foreign exchange was generally attributed to the European demand for the dollar caused by an announcement from Ramsay Macdonald which was construed as a demand that King George should turn the government of the Empire over to the labor party, and the apparent certainty that France would have to issue a large internal loan to balance her budget.

The fact seems to be that much of England's liquid capital is being transferred to this country because it is feared that the domination of labor means socialism, and the same thing is happening in France because even the peasantry are beginning to doubt whether the enormous and rapidly increasing debt of the nation can ever be paid.

While to those who understand the mechanism of the foreign exchange market it is of course plain that no very large share of Europe's wealth can be sent here by buying dollars it is undeniable that the depreciation in francs and sterling is popularly interpreted to mean the progressive impairment of credit and purchasing power on the other side the Atlantic.

This being the case it seems unreasonable to expect buoyant markets in this country, and although most of the New Year forecasts were optimistic, quietude has been the distinguishing characteristic of the week. This is reflected by a disposition to "take a rest" that is discernible in some important quarters.

This is natural and seasonal. Last year's crops have been harvested and sold, and it is too early to predict what this year's yield will be. The railroads claim to have spent about three billion dollars in betterments during the last twelve months. Many of the important improvements planned are now nearing completion and a considerable number of men have recently been laid off.

The department stores are taking inventories as their trade is always relatively small during January. As the immediate need for new housing was partially satisfied by the extraordinary building activity of last year there has been some decline in the new construction planned.

The habit of taking a Winter vacation is spreading and many thousands are already on their way to Florida, California, Europe and South or Central America. An unusually mild Winter has left many retailers with large stocks of heavy goods on hand. These must be moved and some sensational price cutting is being advertised. The effect has been a decided slackening of activity in the market for cotton goods and more cotton mills are shutting down.

What's Doing in Industry

The year 1924 opened under better business auspices than any of the past three years and from all indications bids fair to outdo any of the recent years from a standpoint of prosperity.

All plans are made for a production equally as large as 1923 of automobiles and trucks, and leaders in the automotive industry feel sure that there will be no trouble in disposing of the cars made.

Railroad buying of new equipment and the expansion of repair shops have been promised by the major lines. Smaller lines profiting from 1923 business also will be buyers.

Conditions point to a steady demand for woodworking machinery.

In the electrical field business has been unusually brisk this Winter and no let-up is expected. Small electrical goods and radio equipment are in active demand.

Street railways made some money last year and expect better returns in 1924. Schedules for the coming year call for much heavier buying of equipment and tools.

Some attention will be diverted from business to politics, and while there is a possibility of a slight decrease in demand after the middle of the year, economists predict satisfactory yearly totals.

Everyone seems to agree that a large acreage will be planted to cotton this Spring and as the possibility of a big crop next season commences to cast its shadow before it may be that the strength of the immediate will be sapped by the weakness of the more distant future.

Sugar has shown a reactionary tendency. So has coffee. The speculation in grain is very light and prices have not changed much, although the market has been somewhat easier of late than it had been.

The automobile industry and the steel mills are about the only lines in which any real *verve* is noticeable. The automobile manufacturers seem to be confident that they can market 3½ million cars during the year 1924 and their buying may partially explain the improved demand for steel that is reported.

But the commercial lassitude of the midwinter season is working a reduction in bank loans and creating a plethora of credit that favors the investment market, where both bonds and stocks have been firm and also have been higher.

The weekly statement of the Federal Reserve Banks shows a gain of $11,000,000 in the gold held, a decrease of $40,000,000 in commercial rediscounts and a contraction of $95,000,000 in the circulation. The reserve ratio stands at 73.8 per cent, but it would have been higher if the member banks had not increased their balances by $89,000,000. The total "earning assets" of all the Federal Reserve Banks are now but $1,271,000,000, and as the expenses of the System for 1922 were about $31,000,000 it is plain that in order to make even a small profit the banks will soon have to find a way to employ a larger portion of their resources, which now amount to over $5,000,000,000.

To do this they must either reduce their rates so as to encourage borrowing or buy Government bonds. Either course will benefit the stock market. This is why so many close students of financial conditions expect an advance in stocks and bonds in the near future. They are probably right for most corporations, especially the railroads, did well during the year 1923 and good earnings plus cheap money are a combination that rarely fails to lift security prices.

The only deterrents in the way are the Congressional deadlock and the Mexican resolution. To both of these the American people are so inured that neither are likely to have much effect upon them.

Increase in Exports of Machine Tools

Unmanufactured cotton as usual occupied first place in value of United States exports at the end of the third quarter of 1923, heavy shipments being made in September to England, Germany, France, Italy, and Japan. Continued heavy exports of coal, automobiles, and gasoline kept those commodities secure in their hold on second, third, and fourth places among American exports, according to the analysis of the foreign trade of the United States for the first three quarters of 1923, just issued by the Foreign Commerce Department of the Chamber of Commerce of the United States.

Prominent among the gains in value of exports over the same nine months of 1922 were coal and coke 170 per cent; iron and steel products as a whole 20 per cent; tools 38 per cent; pipes and fittings 30 per cent; bars and rods 11 per cent; machinery as a whole 21 per cent; mining, oil-well, and pumping machinery 43 per cent; internal-combustion engines 26 per cent; typewriters 20 per cent; metal-working machinery 10 per cent; electric motors and starters 104 per cent; agricultural machinery and implements 110 per cent; automobiles and parts 69 per cent; and railway cars 18 per cent.

French Freight Cars Need Repairs

Shippers in France are complaining of the impossibility of getting freight cars in sufficient quantity put at their disposition. This is called by the popular press the "rolling stock crisis." It is, however, more particularly a crisis in production and repair of rolling stock.

Before the war France had 350,000 freight cars. There were abandoned to the enemy around 55,000 cars, but under different forms the Germans left behind 70,000, the English turned over 56,000 and the American Army 55,000 while the French government itself had built 30,000 cars. Immediately after the war, France appears to have had something like half a million freight cars, an increase of nearly 50 per cent when tonnage capacities are taken into consideration. To be sure they have nothing like the big American cars as yet but the twenty, thirty and forty ton car is making its appearance. Besides this the railways themselves ordered a certain quantity from private firms.

Where all these cars have gone, on what vague sidings they may be hidden away no one seems to know. The opinion was hazarded recently by a "personality unusually qualified" that they were largely in the repair shops. This then must be accepted as the answer. Indeed it may be accepted without question as both freight and passenger rolling stock in France is about as low in point of repair as it well could be and render any service, due solely to the war.

Almost without exception the company shops are greatly incapacitated for the work in hand, the state of spirit is considerably changed and output is considerably less than before the war. It was bound to be 20 per cent less by reason of the adoption of the eight-hour law. Certain indispensible repairs are carried on and it is said that many railway shops that should be employing hundreds are actually running with a smaller working force.

One example will suffice to call attention to French deficiencies in this respect at the moment: There are but six plants producing wheels and axles in France. With an average production of 350 to 400 axles per month there are at best but 2,400 axles available for mounting per month, say for twelve hundred cars.

The irony of this is that the claim is made that under pressure France in its specialized shops can build 20,000 freight cars per annum. To fit them out there are but 14,000 sets of axles and wheels, to say nothing of other demands which may be made for these elements for repairs.

Fare Reduction for S.A.E. Detroit Meeting

Arrangements have been made for members of the Society of Automotive Engineers to obtain reduced railroad fares to the annual meeting in Detroit, Jan. 22-25. The plan will operate the same as during past annual meetings and will entitle members using the proper certificates to buy return tickets from Detroit to their homes at half price, L. Clayton Hill, assistant manager of the society announces.

Trade Catalogs

Portable Electric Machinery. The Hergi Manufacturing Co., Bridgeport, Conn. An outfit for pattern makers consisting of ¼ hp. ventilated type motor, special brace and bracket for use in a verticle, suspended or horizontal position, two wrenches, can of grease, a super-service drop cord and switch, together with a set of 14 assorted file cut and mill cut high-speed burs, a sanding drum, a grinding spindle for wheels having ½-in. holes, and one 3-in. wheel, is described and illustrated in this broadside.

Transformers. The Wagner Electric Corp., St. Louis, Mo. The Wagner transformer is illustrated in this folder that has recently been mailed to the trade.

Welding Machines. The Wilson Welder & Metals Co., 132 King St., New York City. This company has recently issued a new catalog illustrating and describing the Wilson welding machines and the Wilson welding metals together with a number of attractive photographs of large electric welding jobs and steel tank work.

Plating Apparatus. The U. S. Galvanizing & Plating Equipment Corp., 32 Stockton St., Brooklyn, N. Y. The merits of the U. S. moving cathode apparatus for plating and electro-galvanizing are put forth together with illustrations of the many well-known products that are plated by this process, in this broadside.

Micarta. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. This 24-page booklet is entitled "A Material of Endless Possibilities" and contains information about Micarta and the many uses to which it has been put and indicating the possibilities for other applications. Some of the products for which Micarta is already used are bushings, cord terminals, discs, fan blades, gears, gaskets, handles, insulators, knobs, pinions, pulleys, radio panels, switchboards, telephone apparatus, and washers.

Pickle-Control Liquid. American Chemical Paint Co., 1126 So. Eleventh St., Philadelphia, Pa. The effect of Rodine extract on surfaces and the virtues of this process in removing scale and rust are described in this four-page folder.

Portable Rivet Heating Furnaces. F. J. Ryan & Co., Philadelphia, Pa. The Mires oil fired portable rivet heating furnace is described and illustrated with a half-tone and sectional drawings.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Equipment for regrinding shop. Adelaide, Australia. Purchase. Reference No. 8724.

Machine tools. Buenos Aires, Argentina. Agency. Reference No. 8727.

Pumps for irrigation purposes equipped with boilers and engines. Lourenco Marques, Portuguese East Africa. Purchase and agency. Reference No. 8705.

Machinists' hand tools. Buenos Aires, Argentina. Agency. Reference No. 8727.

Small tools for metal workers. Prague, Czechoslovakia. Purchase. Reference No. 8763.

Forthcoming Meetings

American Engineering Council. Annual Meeting. Shoreham Hotel, Washington, D. C., Jan. 8 to 11. L. W. Wallace, Executive Secretary, 24 Jackson Place, Washington, D. C.

Gas Products Association. Tenth Mid-Winter Convention. The Blackstone Hotel, Chicago, Ill. Jan. 17, 18 and 19. C. T. Price, 140 S. Dearborn St., Chicago, Ill., secretary and treasurer.

American Society of Safety Engineers. Annual Meeting. Engineering Societies Building, 29 W. 39th St., New York City. Jan. 22.

Engineering Section of the National Safety Council. Joint meeting with the American Society of Safety Engineers. Engineering Societies Building, 29 W. 39th St., New York City. Jan. 22.

American Society for Steel Treating. Winter sectional meeting. Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

American Gear Manufacturers Association. Spring Meeting, April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 19, 20, 21 and 22. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Dividion V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

The Lyons Fair. Lyons, France. March 3 to 17, 1924. Information furnished by Emile Garden, 50 Church St., New York City.

New and Enlarged Shops

Machine Tools Wanted

Ala., Birmingham—R. E. Boggs, 1315 Jefferson County Bank Bldg. (machinery)—one plate bending roll, pyramid type, ¾ in. plate, 12 to 16 ft. between housings (used).

D. C., Wash.—Southern R.R. Co., 17th St. and Pennsylvania Ave., C. R. Craig, Genl. Purch. Agt.—42 in. vertical boring mill.

Ind., Glenwood—McGraw & Son—lathe for garage.

Ind., Metamora—H. E. Crawford (blacksmith and general repair shop)—drill press.

Ind., Metamora—Whitewater Garage Co., D. Bates, Purch. Agt.—drill press.

Ind., Morristown—Brennan Sales Co.—cylinder grinder and lathe for garage.

Minn., Duluth—Oliver Iron Mining Co., Woolvin Bldg., R. E. Mace, Purch. Agt.—receiving bids until Jan. 25 for $100,000 worth of machine tools, including two lathes, boring machine, radial drill, drill grinder, sensitive drill, wood surfacing machine and steam hammer; $770,000 worth of mining equipment, including two 30 and 40 ft. span locomotive cranes for Hibbing and Virginia Dists., three electrically operated churn drills, etc.

Mo., Kansas City—Kansas City Front Drive Motor Co., 2131 Washington St.—No. 3 Kampsmith milling machine, hacksaw and drill press, ½ in. or larger.

N. Y., Buffalo—S. Bogman, William and Adam Sts.—equipment for garage repair shop.

N. Y., Buffalo—Bway. Cedar Drive-In Inc., 321 Bway.—equipment for garage repair shop.

N. Y., Buffalo—E. C. Cook Wagon Wks., 77 East North St.—hammers, 10 in. lathe and welding machines.

N. Y., Buffalo—Hertel Auto Accessories, 1707 Hertel Ave.—equipment for garage repair shop.

N. Y., Le Roy—W. J. Conlon, 77 Wolcott St.—small lathe, drill press, tools and acetylene welding outfit for automobile repair shop.

N. Y., New York—Automobile Clock Co., 144 West 18th St.—one V. & O. or Bliss press.

N. Y., Rome—Three Way Garage, 110 Kossuth St., J. P. Olson, Purch. Agt.—automobile repair tools, including emery wheel, drill press and small repair tools.

O., Columbus—Arch City Machine Wks., Vine and Market Sts., C. L. Mahnicke, Purch. Agt.—small lathe, grinder and other equipment.

O., Columbus—Universal Milking Machine Co., 509 Charles St., J. A. Schmidt, Pres.—screw machine, punch press and boring machine.

O., Columbus—Weinman Pump Mfg. Co., 274 Spruce St., W. N. Weinman, Pres.—drill press, small lathe, etc.

O., Fairpoint—A. Balek—drill press, small lathe and bench tools for garage and repair shop.

O., Luckey—Standard Garage, E. Ernesthaissen, Purch. Agt.—drill press, 10 in. lathe and small tools.

Okla., Commerce—Grimes Motor Co., J. R. Grimes, Purch. Agt.—electric valve grinder.

Okla., Commerce—Liles Motor Co., E. A. Liles, Purch. Agt.—forcing press.

Pa., Berwyn—Keystone Motors Co.—complete machinery and equipment for repair shop, to replace fire loss.

Pa., Patton—Consolidated Brick Co., c/o Prindible—machine shop and grinding room equipment, also general machinery and equipment for brick making for proposed $200,000 plant, to replace fire loss at Horseheads, N. Y.

Pa., Pittsburgh—Pennsylvania R.R. Co., Union Arcade, W. G. Phelps, Purch. Agt.—boring mill, 18 in. lathe, hydraulic press and grinder for Sharpsburg.

Pa., Warren—Barnhardt-Davis Co., Irvine St. (machine shop and manufacturer of oil engines), A. A. Albaugh, Purch. Agt.—machine tools, including shapers, reamers, drilling and milling machines, 14 to 16 in. lathes, etc., to replace fire loss.

Pa., Wilkes-Barre—Davis & Kerrigan, 151 Park Ave.—bench tools, press, small lathe and electric welding outfit for automobile repair shop.

Wis., Janesville—Ackermite Bearing Co., c/o P. J. E. Wood, East Milwaukee Ave.—buffing machine and drill press.

Wis., Milwaukee—Milwaukee Air Power Pump Co., 8 Keefe Ave.—machine tools for proposed $40,000 addition to factory.

Wis., South Milwaukee — Auto Service Tool Co., Box G, L. E. Hendee, Purch. Agt.—machine tools, including drill press and lathe.

Ont., Toronto—The city, City Hall—repair equipment and tools for proposed $100,000 garage on River St.

Ont., Toronto — Dominion Alloy Steel Corp., Royal Bank Bldg.—steel rolling equipment, stamps, punches, shearing machines, benders, riveters, drills, lathes, conveyors, etc., for proposed $5,000,000 steel plant at Sarnia.

Que., Montreal—N. Berlleau, 2764 Blvd. St. Laurent—electric drill for automobile repairs.

Que., Montreal — P. Chevalier 443 Colonial Ave.—general machine tools and wheel puller for automobile repairs.

Que., Montreal — N. Dauphinais, 2210 Blvd. Gorin—drill press for garage repair shop.

Que., Montreal—J. E. Desjardines, 700 Workman St.—lathe, etc., for automobile repairs.

Que., Montreal—J. Desjardines, 1248 St. Catherine St., E.—lathe, tools and equipment for automobile repair shop.

Que., Montreal — A. Dionne, 1603 St. Catherine St., E.—bench lathe for machine shop.

Que., Montreal—J. A. Fortier, 3099 Notre Dame St., E.—lathe and tools for garage.

Que., Montreal—G. J. Lunn & Co., 134 Chatham St. (machinist)—lathe.

Que., Montreal—J. MacGregor, 1106 Clarke St.—drill for automobile repair shop.

Que., Montreal—D. Marleau, 116 Turgeon St.—drill press, chain hoist and small tools for garage repair shop.

Que., Montreal—J. Pepin, 109 Carriere St.—tools, press and equipment for garage.

Que., Montreal—E. Scott, 734 St. Paul St., W. (machinist)—boring machine.

Que., Montreal—Signore, Registered, 631 Dorchester St., E., H. Signore, owner—drill press and emery grinder for automobile repairs.

Que., Montreal—A. Smart, 318 Craig St., W.—lathe and small tools for automobile repair shop.

Machinery Wanted

Conn., Bridgeport—J. L. Lucas & Son, 3 Fox St.—200 lb. automatic hammer for machine shop.

Ill., Rockford—H. W. Carmichael Co., 414 East State St.—separators and special process machinery for milk condensing plant.

Ind., Metamora—D. M. Gordon (woodworking)—lathe, jointer, ripsaw and cutting off machine.

Ind., Morristown—R. E. Clegg (blacksmith)—bandsaw (used).

Ia., Grinnell—Register—intertype crucible.

Md., Baltimore—Baltimore & Ohio R.R., Baltimore and Charles Sts., W. S. Galloway, Purch. Agt.—six 25 ton locomotive cranes, 50 ft. boom.

Mass., Chelsea (Branch of Boston) — School Com—manual training equipment for proposed $652,000 high school.

Mass., Waltham (Branch of Boston)—P. Salmacci, 55 Pond St.—cement block machine (used).

Mich., Iron Mountain—Walstrom Bros.—flour mill equipment, including crushing, cleaning and grading machinery.

Mo., Independence—Friderchen Floor Tile Co.—pattern die machines.

Mo., Kansas City—Nafziger Bakery Co., A. Nafziger, Admiral Blvd. and Virginia Ave., Purch. Agt.—equipment for new bakery at St. Louis.

Mo., Liberal—W. A. Martin—newspaper press and equipment (used preferred).

Mo., Nevada—Natl. Asphalt Co., P. C. Hansen, Purch Agt.—about $75,000 worth of machinery and equipment, including breakers, rolls, hammer machines, crushers, etc.

Mo., St. Louis—Missouri-Kansas-Texas R.R. Co., 1520 Ry. Exch. Bldg., G. E. Scott, Purch. Agt.—receiving bids until Jan. 17 for furnishing 150 ton miscellaneous cast-steel castings for locomotives and cars; about 87 ton locomotive and car bolsters and side frames, in such quantities from time to time during the first quarter, 1924, as required by railroad.

Neb., Humboldt—J. A. Yowell—newspaper press and equipment.

N. Y., Albany—Cox Brass Mfg. Co., Van Woert and North Pearl Sts.—10 ton overhead traveling crane for proposed addition to foundry.

N. Y., Amsterdam—H. Chambers & Son, Inc., H. Chambers, Jr., Purch. Agt.—machinery for cutting shells for buttons for new plant at Worcester.

N. Y., Binghamton—Cloverdale Farms Co., 60 Exchange St.—equipment for proposed $150,000 milk products plant.

N. Y., Buffalo—J. Caros, 370 Connecticut St.—candy making equipment.

N. Y., Buffalo—F. P. Wittmeyer, 133 Longnecker St.—machinery and equipment for sash and window frame factory.

N. Y., Newark—Commonwealth Chemical Corp. (manufacturer of chemicals and extracts)—special chemical machinery and equipment, to replace fire loss.

N. Y., Westfield—Westfield Lumber & Coal Co. (manufacturer of sash and doors)—woodworking machinery, including sawing and turning machines, lathes and belting.

O., Akron—McNeil Boiler Co., Crozier and Switzer Sts.—one hydraulic stake riveter, about 12 ft. 6 in. stake for 1,500 lb. pressure, capacity to 1¼ in. rivets.

O., Columbus—Shale Brick Co., Koebel and 20th Aves., J. W. Wilson, Secy.—large dry pan and conveyors for clay and brick.

O., Defiance — Page Organ Co., D. M. Lamson, Purch. Agt.—machinery and equipment for proposed $100,000 addition to plant.

O., Orrville—Sanderson Cyclone Drill Co.—circular shear, hand power operated.

Okla., Commerce—W. R. Roberts (blacksmith)—band saw and planer.

Okla., Picher—Oklahoma Boiler & Sheet Metal Wks., J. E. Landis, Purch. Agt.—boiler riveters and a heavy sheet metal shears.

Okla., Stratford — Watrus Bros. — job printing press.

Pa., Avoca—Avoca Washery, A. Zenke, Purch. Agt. — complete machinery and equipment for proposed $75,000 coal washery.

Pa., Darlington—Darlington Clay Products Co.—complete equipment, including conveyors and brick making machinery, to replace fire loss.

Pa., Erie—Erie Cabinet & Constr. Co., 641 West 18th St. (manufacturer of building materials and specialties), M. Strohmeyer, Purch. Agt.—woodworking machinery, including lathes and stickers, also belting, shafting and hangers.

Pa., Roaring Spring—D. M. Bare Paper Mill Co., E. G. Bobb, Genl. Mgr.—$100,000 worth of machinery, including large size paper making machines.

R. I., Pawtucket—Pressed Metal Co., D. W. Flint, Cranston (Providence P. O.), interested—equipment for proposed $115,000 factory for the manufacture of metal parts.

Tenn., Nashville—Liberty Brick & Tile Co., F. P. Bond, L. & C. Bldg.—machinery for the manufacture of brick and tile.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Iron and steel scrap market active. Pig iron still apparently weak. Slight gains in buying of refined iron and cold drawn steel bars, also steel plates. Sheets and bars in good demand, mostly for use in the automotive industry. Mild steel bars continue to be quoted at $2.40, with plates and shapes, $2.50 per 100 lb., Pittsburgh.

Advances—Lead buying heavy but in small tonnages; price up 85c. per 100 lb. Zinc advanced 5c. per 100 lb. since the last week in December. Antimony market tending upward; price rose ⅜c. per lb. in New York during week. Washed white wiping cloths up 1¼c. per lb. in New York.

Declines—Electrolytic copper down ¼c. per lb. in week; similar drop occurred in tin. Linseed oil also declined to the extent of 1c. per gal. in New York. Babbitt metal down ¼c. per lb. in Cleveland warehouses. Coke 25c. to 40c. lower per ton at Connellsville.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	2.90@3.00	4.34	3.75	4.00
No. 12	3.00@3.10	4.39	3.80	4.05
No. 14	3.10@3.20	4.44	3.85	4.10
No. 16	3.30@3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.55	4.45	4.70
Nos. 22 and 24	3.75	4.60	4.50	4.70
Nos. 25 and 26	3.80	4.65	4.55	4.75
No. 28	3.85	4.75	4.65	4.85
Galvanized				
Nos. 10 and 11	3.85@4.00	4.80	4.70	4.85
Nos. 12 and 14	3.95@4.10	4.90	4.80	4.95
Nos. 17 and 21	4.25@4.40	5.20	5.10	5.24
Nos. 22 and 24	4.40@4.55	5.35	5.25	5.40
No. 26	4.55@4.70	5.45	5.50	5.55
No. 28	4.85@5.00	5.75	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	¾	$0.16	35%
¼	.11	45%	1	.18	31%
⅜	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00		
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.62½
Tin, 5-ton lots, New York			48.12½
Lead (up to carlots), St. Louis	8.00	New York	8.62½
Zinc (up to carlots), St. Louis	6.30	New York	6.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	27.00	28.50
Antimony (Chinese), ton spot	11.12½	10.50	10.25
Copper sheets, base	21.00	21.00@21.25	23.00
Copper wire, base	16.25	19.00	16.25
Copper bars, base	20.00	22.50	19.50
Copper tubing, base	23.50	27.25	23.00
Brass sheets, base	17.75	22.00	18.75
Brass tubing, base	22.00	27.00	20.50
Brass rods, base	15.50	18.00	15.75
Brass wire, base	18.25	22.00	.....
Zinc sheets (casks)	10.25	10.45	.....
Solder (½ and ½), (case lots)	33.75	31.75	30.00
Babbitt metal (83% tin)	52.00	57.25	48@52
Babbitt metal (35% tin)	25.00	19.00	22@25
Nickel (ingot and shot)	29.00	.....	.....
Nickel (electrolytic)	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.7	11.00	11.50
Copper, heavy, and wire	10.75	10.50	10.75
Copper, light, and bottoms	9.50	8.75	9.75
Lead, heavy	5.75	5.25	6.00
Lead, tea	4.75	4.00	5.00
Brass, heavy, yellow	7.00	.. ..	7.25
Brass, heavy, red	8.75	9.25	9.00
Brass, light	6.25	5.00	6.25
No. 1 yellow brass turnings	7.00	5.75	6.75
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.11@0.14	$0.15	$0.14
Cotton waste, colored, per lb.	.09@.14	.12	.10½
Wiping cloths, 13¼x13¼, per lb	10.50	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb	11.00	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.94	1.00	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.67½
Lard oil, pure, per gal, 2 to 5 bbl. lots	.76	.73	.71
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.75@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@6.50
White lead, dry or in oil	100 lb. kegs		New York, 14.00
Red lead, dry	100 lb. kegs		New York, 14.00
Red lead, in oil	100 lb. kegs		New York, 15.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.044	0.044	0.039
Brass rods	per lb	0.155	0.155	0.17
Solder (½ and ½)	per lb.	0.3375	0.3375	0.28
Cotton waste	per lb.	.11@.14	.11@.14	0.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.50
Machine oil	per gal.	0.29	0.297	0.33
Belting, leather, medium	off list	40–2½%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1⅛ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	45%	.....	60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	50%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 5/16 and smaller	65%	.....	.....
Semi-finished nuts, ⅜ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1⅛ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter. *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$3.70 base

Wis., Appleton—Appleton Wire Wks., Atlantic and Law Sts.—wire working machinery for the manufacture of fencing, etc.

Wis., Appleton—Helm Cut Stone Co., 1348 Lawrence St.—stone cutting machinery.

Wis., Beaver Dam — Central Wisconsin Supply Co. (woodworking and lumber)—large air compressor with tank.

Wis., Crandon—Northern Woodenware Co., J. H. Fiebing, Pres.—matcher, surfacer, etc., for proposed $40,000 factory, to replace fire loss.

Wis., Duck Creek (Green Bay P.O.)—Duck Creek Brick Co., C. C. Hansen, Purch. Agt.—brick making and conveying machinery.

Wis., Green Bay — Badger Show Case Co., 133 North Pearl St., J. H. Brueckner, Purch. Agt.—woodworking machinery, including sander.

Wis., Iron River—Kopplin Co.—large re-saw, belting and shafting for planing mill.

Wis., Janesville—Kem Etta Mfg. Co., c/o E. A. Kemmerer, 315 South Wisconsin St. (manufacturer of furniture, etc.)—woodworking machinery, including sticker, sander, etc.

Wis., Janesville—School Bd., L. M. Handke, Clk.—ice machine, several ton capacity.

Wis., La Crosse—R. C. Irvine—newspaper press and equipment.

Wis., Milwaukee—Byrne Bros. Co., 3112 Burleigh St.—gasoline storage tanks and pumps for proposed $50,000 garage.

Wis., Milwaukee—East Side Cut Stone Co., c/o W. C. Wehe, 802 1st Wisconsin Natl. Bank Bldg.—limestone cutting and dressing machinery.

Wis., Milwaukee—Fehler-Hendee Brush Co., 501 Bway., R. Fehler, Purch. Agt.—brushmaking and wireworking machinery.

Wis., Milwaukee—Milwaukee Corrugating Co., 36th Ave. and Burnham St., A. J. Luedke, Purch. Agt.—heavy duty sheet metal working machinery and equipment.

Wis., Milwaukee—Milwaukee Die Casting Co., 297 4th St., F. J. Schroeder, Purch. Agt.—casting machines.

Wis., Milwaukee—Northwestern Malleable Iron Co., 756 Park St., F. L. Sivyer, Purch. Agt.—moulding machines.

Wis., Milwaukee—A. A. Rohrwasser, 115 South Bay St. (printing)—paper cutting machine, 17 in. or over.

Wis., Milwaukee—E. F. Schmidt Co., 475 5th St. (printing)—8 x 12 in. Chandler & Price press.

Wis., Owen — Owen Dairy Co., W. H. Freund, Purch. Agt.—churn, separator, belting and shafting.

Wis., Pewaukee — C. J. Hahn — rock crushing machinery for quarry.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St.—foundry equipment.

Wis., South Milwaukee — Bucyrus Co. (manufacturer of dredging machinery)—complete machinery and equipment for large addition to branch plant at Evansville, Ind.

Wis., Tomahawk—Oelhafen Lumber Co., R. F. D. (manufacturer of lath)—lath mill.

Wis., Watertown—Rock River Paper Co., c/o W. C. Stone, Bank of Watertown Bldg.—special machinery for proposed $40,000 factory for the manufacture of paper products.

Wis., Waupaca—W. F. Kratz (lumber)—large re-saw, bandsaw, belting and shafting.

Wis., West Allis—P. E. Trimhorn, 6813 Greenfield Ave.—air compressor, gasoline storage tank and pump for service station.

Wis., West Allis—West Allis Woodwork Co., 739 61st Ave., R. Koller, Purch. Agt.—woodworking machinery, including turning lathe.

N. S., New Glasgow—J. W. Cummings & Co., Ltd., H. S. Cameron, Purch. Agt.—foundry equipment.

N. S., Pictou—G. J. Hamilton & Co., Ltd.—candy making machinery.

Ont., Cornwall — W. Binkley & Son — foundry machinery and equipment.

Ont., Corewall—Crystal Bottling Wks., A. E. Gaurreau, Purch. Agt. — bottling equipment.

Ont., Cornwall — A. Denesha — foundry equipment.

Ont., Cornwall—A. Eamon, 8th Ave.—small tools and pump for garage.

Ont., Fort William—Fort William Paper Co.—equipment, including pumps, wood grinders, paper machines, rolls, etc., for proposed $3,000,000 addition to plant.

Ont., Hamilton—Dominion Canners, Ltd., Hughson St.—equipment for proposed $40,000 cannery at Niagara Falls.

Ont., Kitchener—Master Milling Co.—equipment for flour mill, to replace fire loss.

Ont., Oshawa—Hambly Bros.—refrigeration machinery and equipment for proposed $50,000 ice plant.

Ont., Sudbury—Sudbury Constr. & Mchy. Co., Ltd.—pattern making machinery.

Ont., Toronto—The city, C. A. Maguire, Chn. Bd. of Control, City Hall—receiving bids until Jan. 22 for Tender 35, revolving gasoline engine operated crane.

Ont., Toronto—Provincial Paper Mills Co., Ltd., 56 University Ave.—machinery, including grinders, wet machines, pumps, etc., for proposed $200,000 addition to paper mill at Port Arthur.

Ont., Toronto—Seaman, Kent Co., Ltd., 268 Wallace St.—planers, jointers, tenoning machines, saws, resaw, lathes, etc., for proposed $250,000 planing mill and woodworking plant at Renfrew.

Ont., Wingham—W. Matthewman—equipment for woolen carding and spinning mill.

Que., Chicoutimi — Chicoutimi Pulp & Paper Co., Ltd.—equipment for production of fibre for newsprint manufacture.

Que., Montreal—Belair & Belair, 712 De Montigny St., E. (manufacturer of sleighs and carriages)—equipment for proposed expansion.

Que., Montreal — Brookride Dairy, 15 Woodstock Ave., Johnston & Porter, Purch. Agts.—bottling and pasteurization equipment.

Que., Montreal — H. Brounstein, 2328 Clarke St. (cabinet maker)—woodworking machinery.

Que., Montreal—G. H. Brown, 9 Brooke St. (dairy)—bottling and pasteurization equipment.

Que., Montreal — Canadian Natl. R.R., McGill St., R. C. Vaughn, Dir. Purchases and Stores—complete equipment for carpenter shop, to replace fire loss at Port Arthur.

Que., Montreal—The city, H. A. Teatreault, Dir. of Purch.—equipment for proposed $80,000 asphalt plant.

Que., Montreal — David & Frere, 530 Champlain St.—candy making machinery.

Que., Montreal—G. Faille, Marrou St.—crushing machinery for quarry.

Que., Montreal—Gagnon & Dubeau, 2357 Notre Dame St., E.—chain hoist and air compressor for garage.

Que., Montreal—S. Hogan, 643 St Hubert St.—24 in. paper cutter.

Que., Montreal—Holmes-Keeley Lumber Co., Ltd, c/o P. A. Badeaux, 145 St. James St.—equipment for saw and shingle mills.

Que., Montreal—Joliceur Ltd., 1020 Parthenais St.—laundry equipment.

Que., Montreal—B. Karasinsky 1094 St. Lawrence Blvd. (cabinet maker)—woodworking equipment.

Que., Montreal—Marchand Freres, Ltd., 533 Craig St., E., F. Marchand, Purch. Agt.—multicolor printing press, possibly saw cutter.

Que., Montreal—Miller Bros., 6346 Durham Ave.—machinery and equipment for planing mill.

Que., Montreal—W. Mongeau, 6 Ave. Shamrock—tools, vise, etc., for garage.

Que., Montreal—A. Morel, 457 Amherst St.—job printing press, belting, etc.

Que., Montreal — L. Parisien, 1534 Cadieux St.—anvil, forge, etc., for blacksmith shop.

Que., Montreal—J. Pleau, 379 Montana St.—small job printing press.

Que., Montreal—Purity Ice Cream Co., Ltd., 218 Mountain St., E. Frechette, Purch. Agt.—creamery equipment.

Que., Montreal—Rankin & Thorne, 343 Clarke St.—tapering machine, etc., for automobile repairs.

Que., Montreal—H. Trudeau, 2360 Blvd. Gouin—air compressor, etc., for service station.

Que., Montreal—R. C. Watson, 2429 Blvd. Rosemont—gasoline tank and pump for garage.

Que., Montreal—A. E. Williams, 554 St. Denis St.—small job printing press.

Que., St. Therese de Blainville — Willis Piano Co., Ltd., W. D. Willis, Purch. Agt.—machinery and equipment for expansion program.

Que., Sherbrooke—MacKinnon Steel Co., Ltd., G. D. MacKinnon, Purch. Agt.—complete equipment for new plant on Hamilton St., Montreal.

Que., Verdun—W. Barrette, 453 Church Ave.—emery wheel and stand for automobile repair shop.

Que., Verdun—A. R. Grouard, 4 Lasalle Rd.—air service equipment, emery wheel and stand for garage.

Que., Westmount—B. Short, 1352 Greene Ave. (cabinet maker)—jointer and planer.

Metal Working Shops

Calif., Azusa—The Paramount Motors Corp. plans to build a factory, here. Cost will exceed $1,000,000. F. S. Lack, California Bank Bldg., Los Angeles, Pres.

Calif., Redondo Beach — The Kroyer Tractor Co., Cherokee Lane, Stockton, plans to build a factory, here.

Calif., Sacramento—The Pacific Gas & Electric Co., 445 Sutter St., San Francisco, plans to build car barns and machine shops on 28th and M Sts., here. Estimated cost $100,000. Private plans.

Calif., San Francisco—The Cowell Estate Co., 2 Market St., is having plans prepared for the construction of a 3 story garage on The Embarcadero. Estimated cost $130,000. H. Meyers, Kohl Bldg., San Francisco, Archt.

Conn., Hartford—J. Rome, 59 Adams St., is having plans prepared for the construction of a 2 or 3 story garage on Ann St. Estimated cost $55,000. F. C. Waltz, Trumbull St., Hartford, Archt.

Fla., Miami—The Unger Buick Motor Co., is having plans prepared for the construction of an 84 x 200 ft. garage. Estimated cost $60,000. Pfieffer & O'Reilly, Lemon City, Archts.

Ill., Chicago—The Continental Can Co., 4633 West Grand Ave., awarded the contract for the construction of a 1 and 3 story, 160 x 180 x 200 x 290 ft. factory at 4626-54 West North Ave. Estimated cost $650,000. Noted Dec. 13.

Ia., Dubuque — The Belsky Motor Co., 6th and Iowa Sts., awarded the contract for the construction of a 3 story, 100 x 103 ft. garage. Estimated cost $200,000. Noted Dec. 20.

Ky., Louisville—The Consolidated Realty Co., 229 5th St., plans to build a 3 story, 60 x 100 ft. garage, etc., at 428 West Chestnut St. Estimated cost $50,000.

Ky., Louisville — The Ford Motor Co., Highland Park (Detroit P. O.), Mich., is receiving bids and will open same about Jan. 12 for furnishing structural steel for assembly plant, here. Cost will exceed $100,000, total cost $1,000,000. A. Kahn, Marquette Bldg., Detroit, Archt. Noted Sept. 20.

Ky., Louisville—The Standard Sanitary Mfg. Co., 6th and A Sts., is having plans prepared for the construction of a 4 story, 160 x 450 ft. first unit of foundry and factory for the manufacture of plumbing fixtures on 7th St. Estimated cost $750,000. Joseph & Joseph, Francis Bldg., Louisville, Archts. Noted Nov. 29.

Mass., Dorchester (Boston P. O.)—F. W. Doyle, Adams St., awarded the contract for the construction of a 2 story, 70 x 150 ft. garage. Estimated cost $60,000.

Mass., Springfield — H. J. Perkins, Dwight St., awarded the contract for the construction of a 1 story, 90 x 160 ft. garage and showroom on Taylor St. Estimated cost $45,000.

Mich., Niles — The Kawneer Mfg. Co., manufacturer of store fronts and steel mouldings, awarded the contract for the construction of two 1 story, 100 x 125 ft. and 48 x 130 ft. factory buildings, also 2 story, 100 x 212 ft. warehouse.

Minn., St. Paul—The Piper & Drake Co., 809 1st Natl.-Soo Line Bldg., Minneapolis, is having plans prepared for the construction of a 1 story garage on Smith Ave. and Chestnut St., here. Estimated cost $75,000. A. M. Lindell, 319 Meyers Arcade, Minneapolis, Engr. and Archt.

N. Y., Albany—The Cox Brass Mfg. Co., Van Woert and North Pearl Sts., will build a 1 story, 65 x 84 ft. addition to foundry for moulding department. Estimated cost $43,000.

N. Y., Brooklyn—D. Schneider, c/o Cohn Bros., Engrs. and Archts., 361 Stone Ave., will build a 1 story, 100 x 200 ft. garage on Henry St. Estimated cost $50,000.

N. Y., Horseheads — The Consolidated Brick Co., Westlake St, c/o G. Prindible, Patton, Pa., plans to rebuild its brick plant, including machine shop, etc., which was destroyed by fire. Estimated cost $200,000.

N. Y., New York—The Western Electric Co., 195 Bway., will soon award the contract for the construction of an 11 story factory on Washington St. Estimated cost $600,000. McKenzie, Voorhies & Gmelin, 342 Madison Ave., New York, Engrs. and Archts.

Ont., Sarnia—The Dominion Alloy Steel Corp., Royal Bank Bldg., Toronto, is having plans prepared for the construction of a 1 and 2 story steel plant, here. Estimated cost $5,000,000. R. D. Nye, 410 Royal Bank Bldg., Toronto, Engr.